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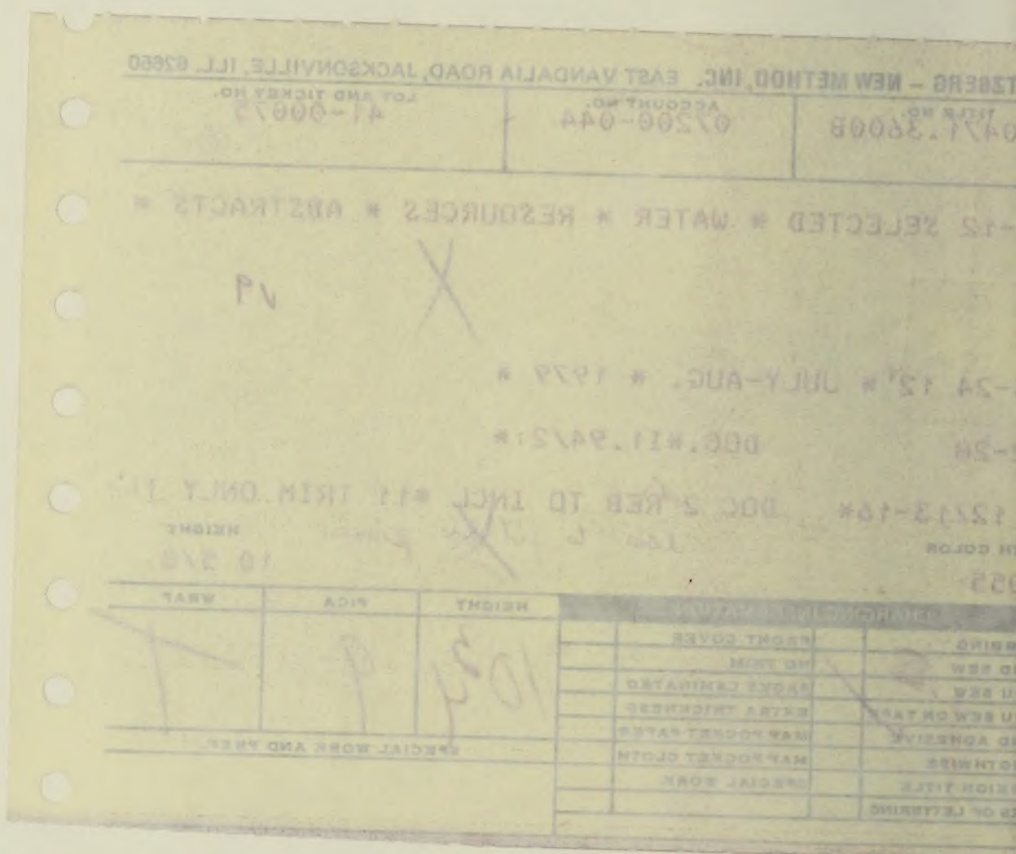

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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 13
JULY 1, 1979

W79-06001--W79-06500

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
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10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

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ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

NUCLEATION AND GROWTH OF ICE CRYSTALS,
Rocketdyne, Canoga Park, CA.
J. Farrar, and K. Youel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-210 535, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 157, February 1966. 61 p, 17 fig, 7 tab, 32 ref. 14-01-0001-333.

Descriptors: *Nucleation, *Freezing, *Ice, *Catalysts, Chemical reactions, Crystal growth, Electrolytes, Drops(Fluids), Particle size, Emulsions, Sea water, Heat, Mass transport, Supercooling, Irradiation, Thermal conductivity, Separation techniques, Desalination.

Experimental techniques were used to observe the beginning of ice growth in water, and to study the catalytic effectiveness of chemical and mechanical nucleation stimuli. Nucleation rates were determined as functions of the sample size and sample source, the concentration of electrolytes and suspended matter, and the intensity of mechanical agitation. Conclusions were drawn in the following areas: behavior of bulk water, effect of particles, nucleation of water drops, and nucleation in water-oil emulsions. Ice nucleated heterogeneously in all experiments. Data from droplet and nucleation studies were compared with nucleation data obtained for octadecane and mercury and the predicted rates for homogeneous nucleation in water, and were found to be in agreement with the liquid-solid interfacial energies of these materials. This substantiates the Turnbull-Fisher theory of nucleation in condensed systems. (Davison-IPA)
W79-06425

2. WATER CYCLE

2A. General

THE EFFECT OF INTERCEPTED RAINFALL ON THE WATER BALANCE OF A HARDWOOD FOREST,
Montreal Univ. (Quebec). Dept. of Geography.
B. Singh, and G. Szeicz.
Water Resources Research, Vol 15, No 1, p 131-138, February 1979. 5 fig, 3 tab, 17 ref.

Descriptors: *Rainfall, *Interception, *Forests, *Water balance, Model studies, Mathematical models, On-site investigations, Evaporation, Evapotranspiration, Trees, Hardwood, Runoff, Soil water, Wetting, Drying, Canopy, Meteorology, Forest water balance, Intercepted rainfall.

Evaporation from a large hardwood forest was estimated from measurements of the required meteorological variables and from measured stomatal resistances. A correction factor was derived to overcome the incorrect assumption that evaporative demand remains the same during wet and dry periods. The factor was based on the ratio of the isothermal resistances during the wet and subsequent dry periods. The stomatal measurements were converted to canopy resistances by dividing by the leaf area index, and the stomatal measurements were used to obtain the water balance for the entire season. The results were analyzed to show that evaporation from a wet canopy is often 2-3 times greater than transpiration from the same surface. Rates of interceptional loss, calculated from the wet and dry evaporation rates, were verified by direct measurements of throughfall and stemflow. Net interceptional loss, equal to the excess evaporation from a wet canopy over a dry one, depended on rainfall duration and character and was on the average about 60-80% of total interception. In the overall summer water balance of 442 mm of precipitation and 52-mm depletion of soil storage, transpiration via the trees accounted for 261 mm, evaporation from the wetted leaves and branches for 111 mm, and runoff for 131 mm, giving an error of closure in the water balance of only 9 mm. If transpiration only had been used instead of interception when the canopy was wet, the error in the water balance would have been 100 mm. (Sims-ISWS)
W79-06072

TIME AND LENGTH SCALES FOR THE ONE-DIMENSIONAL ASSUMPTION AND ITS RELATION TO ECOLOGICAL MODELS,
Army Engineer Waterways Experiment Station, Vicksburg. Environmental Effects Lab.
For primary bibliographic entry see Field 2H.
W79-06073

WATER BALANCE ESTIMATE FOR GEORGIAN BAY IN 1974,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. Schertzer, E. B. Bennett, and F. Chiocchio.
Water Resources Research, Vol 15, No 1, p 77-84, February 1979. 3 fig, 5 tab, 21 ref.

Descriptors: *Water balance, *Bays, *Great Lakes, On-site investigations, Current meters, Currents(Water), Runoff, Precipitation(Atmospheric), Groundwater, Evaporation, Inflow, Discharge(Water), Water levels, Meteorological data, Hydrology, *Georgian Bay.

Current meter observations and hydrological and meteorological data collected primarily during 1974 formed the basis upon which the monthly water balance of Georgian Bay could be estimated. The data were used to derive a first approximation of the exchange of water between Georgian Bay and main Lake Huron. The net exchange across Main Channel at depths greater than 5 m was determined from extensive current meter observations, while the exchange in the upper 5 m was the residual necessary to achieve a balanced water budget. The results illustrate that during the stratified season (May through November), the transport of water through Main Channel is also stratified, with surface water moving into Georgian Bay from main Lake Huron; while continuity is maintained by net outflow at depths greater than 5 m. Total annual supply from runoff and direct precipitation is nearly twice as large as combined losses from evaporation and flow to North Channel. Residence and flushing times for water in the bay were estimated at 5.1 and 5.7 years, respectively. (Sims-ISWS)
W79-06076

GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES,
Arizona State Univ., Tempe. Dept. of Geology.
E. Babcock, P. Briggs, K. DeCook, L. Ethridge, and K. Foster.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 816, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Tucson, Project Completion Report, April 1979. 92 p, 32 fig, 8 tab, 97 ref. OWRT B-066-ARIZ(1). 14-34-0001-8060.

Descriptors: *Groundwater, *Remote sensing, Landsat, Lineaments, Arizona, Aerial photography.

There is an increasing need for dependable municipal and agricultural water supplies, in addition to supplies needed by the rapidly expanding, coal-fired power plants, in the Four Corners Region of the Southwest. It has been previously shown that well production in northern Arizona sandstone aquifers is enhanced by deep fracturing. If such fractures extend to the surface, corresponding fault patterns may provide a basis for exploration for additional water supplies. In this study, photolineaments of the entire northeast quadrant of Arizona were mapped from standard EROS Data Center false color Landsat composites. In addition, photolineaments were mapped using computer-enhanced Landsat imagery of two intensive study sites. A third source of geologic structure data were existing large scale lineament maps derived from aerial photography of the study sites. Several spatially-distributed parameters obtained from these maps, such as lineament density and well-to-lineament distance are mathematically correlated with water well survey data (specific capacity, specific conductance, transmissivity, and water temperature) within the study sites to establish the most useful combination of data for extension of 'lineament signatures' throughout the entire northeast quadrant. Results indicate that Landsat imagery may be used to survey large areas for lineaments, and to cue the hydrogeologist to promising regions, which can then be mapped at aerial photography scales.
W79-06164

APPLICATIONS OF RECURSIVE ESTIMATION TECHNIQUES TO TIME VARIABLE HYDROLOGICAL SYSTEMS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W79-06251

INSTANTANEOUS UNIT HYDROGRAPH WITH NEGATIVE ORDINATES--POSSIBLE,
Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
For primary bibliographic entry see Field 2E.
W79-06257

INITIAL EFFECTS OF CLEARCUT LOGGING ON SIZE AND TIMING OF PEAK FLOWS IN A SMALL WATERSHED IN WESTERN OREGON,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forest Sciences Lab.
For primary bibliographic entry see Field 2E.
W79-06260

HYDROLOGIC MONITORING IN THE AREA OF THE TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI-ALABAMA, FISCAL YEAR 1978,
Geological Survey, Jackson, MS. Water Resources Div.
J. D. Shell.
Geological Survey open-file report, March 1979. 154 p, 1 fig, 2 tab, 5 append.

Descriptors: *Hydrologic data, *Inland waterways, *Surface waters, *Groundwater, *Water quality, Aquifers, Well data, Water yield, Water levels, Hydrographs, Water level fluctuations, Streamflow, Flow rates, Sediment transport, Water analysis, Physical properties, Chemical properties, Mississippi, Alabama, *Tennessee-Tombigbee Waterway.

This report, the fifth in a series of data reports prepared at the request of the Corps of Engineers, presents data collected in a study of the hydrologic effects of the Tennessee-Tombigbee Waterway. Included in this report are hydrographs of 149 observation wells, analyses of water samples from 12 wells and 23 surface-water stations, daily discharge for three surface-water gaging stations, and daily summaries of water-quality monitor records at 3 surface-water sites. (Woodard-USGS)
W79-06311

HYDROLOGIC DATA, 1974-77, STOVEPIPE WELLS HOTEL AREA, DEATH VALLEY NATIONAL MONUMENT, INYO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. E. Lamb, and D. J. Downing.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, printed copy $3.25, microfiche $3.50. Geological Survey open-file report 79-203, January 1979. 19 p, 4 fig, 4 tab, 2 ref.

Group 2A—General

Descriptors: *Groundwater resources, *Observations wells, *Water levels, *Water quality, *Streamflow, Hydrologic data, Well data, Base flow, National parks, California, *Death Valley National Monument, *Stovepipe Wells Hotel area, Salt Creek.

Ground-water levels in most wells did not change significantly from 1974 to 1977 in the Stovepipe Wells Hotel area, California. The average water-level decline was less than 0.10 foot between August 1974 and August 1977 in 10 observation wells. Water-level contours show a depression centered on the two pumping wells, but this depression existed before the National Park Service started pumping its well. The chemical quality of the ground water is poor. Dissolved-solids concentrations in water samples ranged from 2,730 to 6,490 milligrams per liter. Analyses of water samples from two wells showed large changes in some constituents from 1976 to 1977. Streamflow in Salt Creek has been monitored since February 1974. Base flow is seasonal, being 0.10 to 0.20 cubic foot per second during the summer and as much as three times that amount during the winter. Two chemical analyses of water from Salt Creek, representing summer and winter flow conditions, show large differences for many constituents. (Woodard-USGS)
W79-06313

SIMPLE NON-LINEAR MODELS FOR THE COOLING OF WELL-MIXED RIVERS,
Vienna Univ. (Austria). Inst. of Meteorology and Geophysics.
P. Kahlig.
Water, Air, and Soil Pollution, Vol 10, No 1, p 61-70, July 1978. 5 fig, 3 tab, 8 ref.

Descriptors: *Water temperature, *Cooling, *Rivers, *Model studies, Mathematical models, Heat transfer, Mixing, Winds, Temperature, Thermal capacity, Depth, Evaporation, Thermal radiation, Equations, Well-mixed rivers.

Using the presently known data of the temperature dependence of the coefficient of heat exchange at an air-water interface, the non-linear equation governing the one-dimensional cooling of a well-mixed river was solved analytically. It turns out that the effects of non-linearity are negligible within the small parameter range occurring in hydrological applications, justifying the use of linear models in one-dimensional river temperature calculations (e.g., exponential method). It was shown that the frequently used assumption of an exponential decay of excess temperature represents an acceptable approximation. (Sims-ISWS)
W79-06396

THE WATERSHED INFLUENCE ON STORM RUNOFF IN SMALL NORWEGIAN RIVERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
E. Ruud, T. Tjomsland, and K. Nordseth.
Nordic Hydrology, Vol 9, No 5, p 277-292, 1978. 5 fig, 2 tab, 21 ref.

Descriptors: *Watersheds(Basins), *Storm runoff, *Correlation analysis, *Model studies, Mathematical models, Effects, Rivers, River flow, Storms, Floods, Runoff, Hydrographs, Rainfall, Regression analysis, Hydrology, *Norway.

A procedure to isolate and investigate the watershed influence on storm runoff was presented. It offers an opportunity to study also the change in influence of particular watershed characteristics by changing the input or soil moisture state of each catchment. Weighted lake area, area of bare rocks, main stream gradient, drainage density, and basin area were found to be the most significant characteristics in affecting peak runoff and time of rise on storm hydrographs in small Norwegian rivers. The intercorrelation structure of the watershed properties was examined. (Sims-ISWS)
W79-06406

THE DYNAMICS OF A DRAINAGE NETWORK,
Southampton Univ. (England). Dept. of Geography.
A. M. Gurnell.
Nordic Hydrology, Vol 9, No 5, p 293-306, 1978. 11 fig, 1 tab, 17 ref.

Descriptors: *Dynamics, *Drainage, *Watersheds(Basins), *Networks, Drainage density, Soil moisture, Precipitation(Atmospheric), Discharge(Water), Vegetation, Vegetation effects, Rocks, Runoff, Antecedent precipitation, Rainfall, Hydrographs, Storms, Storm runoff, Regression analysis, Hydrology.

The dynamics of the drainage network within a small catchment were studied in detail. Variations in the network were related both to transient characteristics of the catchment, including precipitation, soil moisture content, and discharge, and to more permanent characteristics including vegetation and rock type. (Sims-ISWS)
W79-06407

NEW EVALUATION OF THE ADVISABILITY OF SEPARATING THE EASTERN SHALLOWS OF THE NORTHERN CASPIAN,
Akademiya Nauk SSSR, Moscow. i Inst. Geografii.
For primary bibliographic entry see Field 2D.
W79-06413

CLIMATE,
California State Univ., Long Beach.
For primary bibliographic entry see Field 2B.
W79-06451

2B. Precipitation

A STATISTICIAN'S VIEW OF WEATHER MODIFICATION TECHNOLOGY (A REVIEW),
California Univ., Berkeley. Statistical Lab.
J. Newman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 439, Price codes: A02 in paper copy, A01 in microfiche.
Proceedings of the National Academy of Sciences, Vol 74, No 11, p 4714-4721, November 1977. 1 fig, 1 tab, 42 ref.

Descriptors: *Reviews, *Weather modification, *Statistical methods, *Technology, *Cloud seeding, *Methodology, *Analytical techniques, Precipitation(Atmospheric), Droughts, Testing procedures, Policy, Silver iodide, Randomization, Evaluation, Hail, Statistics.

Available evidence on effectiveness of weather modification techniques shows: (1) Present cloud seeding technology has not been reliably confirmed as a means of alleviating draught. (2) Although cloud seeding does affect precipitation and up to hundreds of kilometers beyond intended targets, effects vary from large increases to large decreases in precipitation. (3) Hypothetical mechanisms advanced to explain such effects differ in empirical support and plausibility, and much of existing literature (including from official sources) is slanted and unreliable. (4) At least two philosophically different interdisciplinary research groups, including statisticians, should be established to reevaluate data from experiments already performed, and to continue with properly planned experimentation. Suitable methodology is outlined, and established of a randomization center is recommended. This paper presents examples of contradictory conclusions from the same data, and conclusions derived from faulty methodology; for example, the historical regression technique has been shown to be unreliable, yet it continues to be used in analyzing field tests. Experiments and projects discussed include the Whitetop experiment, Swiss hail prevention experiment, cloud seeding in Arizona's Santa Catalina Mountains, Bureau of Reclamation's Skywater Conferences, Pyramid Lake experiment, Colorado River Basin Pilot Project, National Hail Research Experiment, and Florida Area Cumulus Experiment. (Lynch-Wisconsin)
W79-06045

CLOUD PHYSICS AND WEATHER MODIFICATION.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 740, Price codes: A07 in paper copy, A01 in microfiche.
Translation of FIZIKA OBLAKOV I AKTIVNYKH VOZDEISTVII, 1967. Translated from Russian. Amerind Publishing Co., New Delhi, India. 1977. Levin, L.M. and Litvinov, I.V. (eds). 121 p, 23 fig, 9 tab, 98 ref.

Descriptors: *Weather modification, *Cloud physics, *Clouds, *Precipitation(Atmospheric), *Meteorology, *Raindrops, *Translation, *Foreign research, Condensation, Radar, Measurement, Cloud formation, Chemistry of precipitation, Cloud seeding, Model studies, Equations, Mathematical studies, Reflectivity, Supersaturation, Turbulence, Atmospheric pressure, Atmospheric physics, Atmosphere.

This collection of 10 articles deals with the influence of cloud drop formation on condensation nuclei, factors affecting drop growth, temporal stability of cloud radar reflectivity values, cloud redistribution over a limited area, relative norms of reagent discharge in weather modification, and a method for improving radar cloud measurement accuracy. Individual articles concern: (1) Gravitational coagulation of charged cloud drops in a turbulent medium, using a two-layer turbulence model. (2) Aspects of the theory of atmospheric condensation nuclei accompanied by a theoretical model, with proposal of a fluctuation mechanism of cloud drop formation. (3) Fluctuation of vapor concentration and magnitude of supersaturation in the atmosphere, including discussion of the influence of pressure fluctuation and the problem of smoothing the spectral function of supersaturation. (4) Condensation growth of drop on a hygroscopic nucleus, considered in the quasi-static approximation. (5) Calculation condensation growth time of a drop on a hygroscopic particle, taking into account influence of heat of condensation. (6) Redistribution of precipitation due to nucleation. (7) Temporal stability in radar reflectivity value, showing that its interrelationship with liquid precipitation intensity often changes during a storm. (8) Pressure of water vapor over solution. (9) Relative scale of dispensers in weather modification by crystallizable reagents in supercooled clouds. (10) Surface-active substances action on water drop evaporation. (Lynch-Wisconsin)
W79-06046

THE EFFECT OF INTERCEPTED RAINFALL ON THE WATER BALANCE OF A HARDWOOD FOREST,
Montreal Univ. (Quebec). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-06072

MAXIMUM LIKELIHOOD ESTIMATION OF FOURIER COEFFICIENTS TO DESCRIBE SEASONAL VARIATIONS OF PARAMETERS IN STOCHASTIC DAILY PRECIPITATION MODELS,
Science and Education Administration, Fort Collins, CO.
D. A. Woolhiser, and G. G. S. Pegram.
Journal of Applied Meteorology, Vol 18, No 1, p 34-42, January 1979. 2 fig, 3 tab, 13 ref, 2 append.
NSF GK-31521X.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Model studies, Mathematical models, Fourier analysis, Stochastic processes, Markov processes, Regression analysis, Equations, Optimization, Mathematics, Weather, Meteorology, Climatology.

Methods were investigated to obtain maximum likelihood estimates of the Fourier coefficients to describe the seasonal variability in the parameters for a stochastic rainfall model. Parameters were obtained from a two-state Markov chain model for wet and dry day occurrence, and from a mixed exponential model for distribution of depth on wet days. The procedure was demonstrated on 4 sample stations scattered across the continental United States. A constrained multivariate optimiz-

ation scheme and a simple univariate procedure were used for maximum likelihood estimation, and these were compared with a least-squares estimate. The two seasonally varying parameters for the Markov chain were mutually independent, but the Fourier coefficients for each parameter were weakly dependent. The 3 seasonally varying parameters in the mixed exponential distribution were mutually dependent. However, for the 4 precipitation records analyzed, it appears that acceptable results can be obtained by simultaneously estimating the constant series terms and then independently estimating the harmonic amplitudes and phase angles. A likelihood ratio test can be used to test the significance of each added harmonic. It also appears from this analysis that the significant Fourier coefficients can be plotted on maps as isopleths, providing a concise description of regional precipitation climatology. (Sims-ISWS)
W79-06238

URBANIZATION AND CHANGES IN PRECIPITATION, A STATISTICAL APPROACH,
Royal Netherlands Meteorological Inst., De Bilt.
T. A. Buishand.
Journal of Hydrology, Vol. 40, No. 3/4, p 365-375, February 1979. 3 fig, 6 tab, 5 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Urbanization, Cities, Rural areas, Seasonal, Variability, Effects, Analytical techniques, Data processing, Statistics, Weather, Meteorology, *The Netherlands.

Monthly rainfall data from urbanized and rural areas in the western part of The Netherlands were used to investigate the urban effects upon the rainfall regime. A trend test in the sequence of differences between urban and rural rainfall amounts was described. For the urban areas of Amsterdam and Rotterdam, some evidence was found for an increase in precipitation. (Sims-ISWS)
W79-06248

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W79-06398

CLIMATE,
California State Univ., Long Beach.
J. C. Kimura.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 2-1 - 2-70, September 1974. 37 fig, 15 tab, 26 ref.

Descriptors: *Baseline studies, *Climate, *Cloud cover, *Hazards, Resources development, Environmental effects, Water resources, Precipitation, Coasts, *Outer Continental Shelf.

The immediate coastal zone of Southern California seaward to the western boundary of this study area (121 Meridian) is classified as belonging to the Mediterranean Dry Summer Subtropical climatic type, with a cool summer regime. Along the maritime fringe, temperatures are controlled by the sea. The warm month average is comfortably below 72F, while the cold month average is above 50F. Because of the moist air, the relative humidity at night is high, generally above 90%. As the temperature rises during the day, relative humidity decreases to about 60%. Precipitation is strongly concentrated in winter, with average annual values in the vicinity of 15 inches, decreasing over the sea and the immediate rain-shadows of the islands, and increasing over the coastal mountain slopes. Fewer than half of the days of the year are classed as cloudy (7/10 or more of the sky covered by clouds), and heavy fog averages 53 days per year at Los Angeles International Airport, decreasing to some 30 days at San Diego. The principal could type that contributes to low ceiling and restricted visibility in the Southern California Coastal and Offshore Region is stratus. The sea-surface temperature plays an essential role in the formation of stratus and fog over and near the ocean. In addition to its seasonality, there is a marked diurnal variation in the occurrence of stratus. As this cloud is advected inland a few miles by the sea breeze during the day, heat which the land absorbs evaporates the stratus, while the surrounding sea may be fogged in. (See also W79-06449) (Sinha-OEIS)
W79-06451

2C. Snow, Ice, and Frost

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Army Terrestrial Sciences Center, Hanover, NH.
P. V. Sellmann, E. Chamberlain, S. Arcone, S. Blouin, and A. Delaney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 50-74, October 1978. 7 fig, 2 tab. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. 01-5-022-2313.

Descriptors: *Permafrost, *Sediments, *Baseline studies, Environmental effects, Resources development, Oil spills, Water pollution, Alaska, *Outer Continental Shelf, *Engineering properties, Beaufort Sea, Petroleum development.

The objective of CRREL's subsea permafrost program is to obtain specific information on the distribution and engineering characteristics of permafrost beneath the Beaufort Sea. Observations include determinations of subsea sediment temperature, type, ice content, and chemical composition. The following conclusions were made: Ice-bonded sediments were encountered locally in the upper 10 m of sediment, in water depths of 2 m off the Sagavanirktok delta. The position of the bonded permafrost interface is extremely variable, as would be anticipated in a marginal permafrost zone. The distribution of bonded sediments is strongly related to engineering properties, primarily grain size and degree of initial ice saturation, as well as other factors such as water depth and transgressive and preinundation history of the area. It is not inconceivable that ice-bonded sediments can occur locally nearer the surface of the sea bed with increasing distance from shore. Fine-grained sand, silt and clay sediments occur near the sea bed to beyond Reindeer Island, and are as great as 10 m in thickness. Shallow, highly overconsolidated marine clays occur seaward and slightly shoreward of Reindeer Island in areas that have been studied. If the freeze-thaw mechanism is responsible for their formation, they could be found in many shallow water areas where fine-grained marine sediments occur. (Sinha-OEIS)
W79-06215

OFFSHORE PERMAFROST STUDIES, BEAUFORT SEA,
Geological Survey, Menlo Park, CA.
D. M. Hopkins, and R. W. Hartz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 75-147, October 1978. 1 fig, 10 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado.

Descriptors: *Permafrost, *Hazards, *Drilling, *Baseline studies, Stratigraphy, Sea ice, Boreholes, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea, Pollen chronology, Geothermal profiles, Radiocarbon dates, Petroleum development.

The main objective in this study is to obtain direct knowledge of offshore permafrost by drilling and thermally instrumenting boreholes in the Prudhoe Bay area. Utilizing sea ice as a drilling platform, four boreholes were drilled and cored during the spring of 1977. During 1977 drilling operations intact ice-bonded cores were recovered for the first time and it was established that ice-bonded permafrost is likely to be present within a few meters below the sea bottom at points as much as 17 km offshore. The 1977 boreholes also provide evidence of rapid thermokarst subsidence following initial submergence and they establish that Prudhoe Bay is the remnant of an ancient thaw lake that once extended to Gull Island Shoal. The report presented detailed data on stratigraphy, fossil content, radiocarbon dates, pollen chronology, and geothermal profiles. (Sinha-OEIS)
W79-06216

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06219

SEISMIC AND VOLCANIC RISK STUDIES -- WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 5C.
W79-06221

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
T. E. Osterkamp, and W. D. Harrison.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 570-650, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Hazards, *Permafrost, *Drilling, Baseline studies, Resources development, Environmental effects, Oil pollution, *Outer Continental Shelf, *Thermal regime, Petroleum development, Beaufort Sea, Chukchi Sea.

The objectives are to determine the distribution and properties of subsea permafrost in Alaskan waters. Besides direct measurements, the program includes an effort to understand the basic physical processes responsible for the subsea regime, as a basis for predictive models. Work has been carried out in both the Chukchi and Beaufort Seas, and the conclusions are stated separately for each. To develop proper precaution against potential problems a better understanding is needed for the horizontal and vertical distribution of subsea permafrost and permafrost and the processes that control this distribution. It should be emphasized that drilling data exist only near Barrow and Prudhoe Bay in the Beaufort Sea and that extrapolations to other areas must be highly speculative. For the present the concerns are for the safety of exploratory drilling, but the eventual objective is not only to find, but to produce hydrocarbons. At this stage, permafrost and hydrate conditions will be even more important since hot fluids in the well-bore are unavoidable. Thus, it is very important to maximize the derived downhole information at the initial stage of exploratory drilling. (Sinha-OEIS)
W79-06222

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
J. C. Rogers, and J. L. Morack.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 651-688, October 1978. 9 fig, 1 tab, 19 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulde, Colorado. 03-5-022-55.

Descriptors: *Permafrost, *Hazards, *Seismic studies, *Baseline studies, Resources development, Distribution, Environmental effects, Oil pollution, Alaska, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Thermal models.

The known oil reserves along the Beaufort Sea coast coupled with a national need to develop these resources have focused attention on the distribution and character of permafrost in that area.

This study of coastal offshore permafrost utilizes seismic refraction techniques to probe the ocean bottom. The most important parameter to be determined is the distribution of offshore permafrost. Also, the depth to the top of the bonded permafrost beneath the ocean floor is to be determined. The distribution study has focused primarily on the Prudhoe Bay area with secondary emphasis at Point Barrow. The truncation of permafrost beneath the ocean is of interest, particularly the shape of the frozen-nonfrozen boundary. One import facet of the second objective is determining the nature and extent of the permafrost beneath the barrier islands. These results will provide valuable information for refinement and testing of thermal models as well as for determining operational methods for offshore oil and gas development. The third major objective is to provide information to support reconnaissance drilling programs. (Sinha-OEIS)
W79-06223

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5C.
W79-06227

SEISMOTECTONIC STUDIES OF NORTHEAST AND WESTERN ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 5C.
W79-06230

TRITIUM AND CARBON-14 DISTRIBUTIONS IN SEAWATER FROM UNDER THE ROSS ICE SHELF PROJECT ICE HOLE,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2L.
W79-06241

OCEAN TIDE AND WAVES BENEATH THE ROSS ICE SHELF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W79-06242

CIRCULATION AND MELTING BENEATH THE ROSS ICE SHELF,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2L.
W79-06243

ROSS SEA REGION IN THE MIDDLE MIOCENE: A GLIMPSE INTO THE PAST,
Macquaries Univ., North Ryde (Australia). School of Biological Sciences.
For primary bibliographic entry see Field 2J.
W79-06244

ROSS ICE SHELF SEA TEMPERATURES,
New Zealand Oceanographic Inst., Wellington.
A. E. Gilmour.
Science, Vol. 203, No. 4379, p 438-439, February 2, 1979. 1 fig, 6 ref.

Descriptors: *Water temperature, *Sea water, *Antarctic, *Ice, Cold regions, On-site investigations, On-site data collections, Data processing, Temperature, Instrumentation, Equipment, Sampling, Melting, Circulation, Water circulation, Salinity, Oceanography, *Ross Ice Shelf.

Two temperature profiles recorded by a sensitive bathythermograph at the Ross Ice Shelf Project site (82 deg 22.5 min S, 168 deg 37.5 min W) were presented. From the shape of the profiles it was concluded that an inflow of water at intermediate depths provides a source of heat to drive a regime in which ice is melted from the interface at a depth of 360 meters. Melting maintains the temperature of a thick layer under the ice at about -2.14C, close to the ambient freezing temperature. A very well mixed layer about 35 meters thick was found at the seabed. (Sims-ISWS)
W79-06245

MIOCENE GLACIOMARINE SEDIMENTS FROM BENEATH THE SOUTHERN ROSS ICE SHELF, ANTARCTICA,
Northern Illinois Univ., De Kalb. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W79-06246

THE ROSS ICE SHELF PROJECT,
Nebaska Univ., Lincoln. Ross Ice Shelf Project Management Office.
J. W. Clough, and B. L. Hansen.
Science, Vol. 203, No. 4379, p 433-434, February 2, 1979. 2 fig, 27 ref.

Descriptors: *Ice, *Antarctic, *On-site investigations, *Projects, Drill holes, Drilling, Biology, Marine biology, Oceanography, Temperature, Heat transfer, Currents(Water), Cold regions, On-site data collections, Reviews, *Ross Ice Shelf, Ice shelves.

A hole was drilled through the Ross Ice Shelf 450 kilometers from the barrier. Scientific sampling through this hole revealed a sparse population of crustaceans, fish, and microbial biomass. The seabed consists of mid-Miocene glaciomarine mud. Geothermal heat flow is average. Oceanographic data indicate an active circulation and melting at the base of the ice. (Sims-ISWS)
W79-06247

LAKE ERIE IN MID-WINTER,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W79-06403

2D. Evaporation and Transpiration

A COMPARISON OF TWO FORMULA TYPES FOR CALCULATING LONG-WAVE RADIATION FROM THE ATMOSPHERE,
Agricultural Research Service, Sidney, MT. Northern Plains Soil and Water Research Center.
J. K. Aase, and S. B. Idso.
Water Resources Research, Vol. 14, No. 4, p 623-625, August, 1978. 1 fig, 1 tab, 14 ref.

Descriptors: Radiation, Thermal radiation, Solar radiation, Air temperature, Humidity, Vapor pressure, Estimating equations.

Measurements of long-wave radiation at Sidney, Montana, indicated that both an analytically derived equation and an empirically derived equation for clear-sky conditions adequately predict the long-wave radiation flux at that site for screen level air temperatures above 0C. However, for air temperatures below 0C the analytical equation always underestimated the true radiation, while the empirical equation just slightly underestimated it, then matched it, and then overestimated it, as air temperature decreased from 0C to -37C. These discrepancies in the below 0C temperature regime indicated that the equations might need some modification to conform more closely to reality for low-temperature conditions. (Skogerboe-Colorado State)
W79-06029

EVAPOTRANSPIRATION FROM DOUGLAS FIR STANDS EXPOSED TO SOIL WATER DEFICITS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
T. A. Black.
Water Resources Research, Vol. 15, No. 1, p 164-170, February 1979. 11 fig, 3 tab, 23 ref.

Descriptors: *Evapotranspiration, *Douglas fir trees, *Soil water, Root zone, Trees, Water balance, Energy budget, On-site investigations, Radiation, Solar radiation, Evaporation, Drying, Water storage, Vegetation, Vegetation effects, Forests, Moisture deficit, Analytical techniques.

The rate of evapotranspiration from thinned and unthinned stands of Douglas fir was measured using energy and water balance methods. At high values of soil water storage in the root zone, the evapotranspiration rate was approximately 80% of the equilibrium evaporation rate. Below a critical value of soil water storage, the ratio of the evapotranspiration rate to the equilibrium evaporation rate (E/E sub eq) tended to decrease linearly with decreasing soil water storage. The critical values of soil water storage in the root zone were 11.8 and 8.3 cm for the thinned and unthinned stand, respectively. Below these critical storage values, there was approximately 3.5 cm of water remaining in both root zones that was extractable by the trees. The relationship between E/E sub eq and the fraction of extractable water in the root zone for both stands was very similar for sunny days. In this relationship, E/E sub eq began to decrease when there was approximately 40% of the extractable water remaining in the root zones of both stands. (Sims-ISWS)
W79-06068

ENERGY BUDGET EVALUATION OF THE TRANSPIRATION-PF RELATIONSHIP IN A YOUNG PINE FOREST,
West Virginia Univ., Morgantown. Div. of Forestry.
S. Tajchman, F. Hadrich, and R. Lee.
Water Resources Research, Vol. 15, No. 1, p 159-163, February 1979. 3 fig, 3 tab, 15 ref.

Descriptors: *Evapotranspiration, *Forests, *Pine trees, *Energy budget, Radiation, Heat, Water loss, Temperature, Winds, Humidity, Clouds, Rainfall, Weather data, Data processing, Analytical techniques.

By using the Bowen ratio method, hourly and daily evapotranspiration totals were determined during a drying period for a 9-year-old pine forest situated in the upper Rhine area of Germany. A relationship between the soil water suction, expressed by pF, and the ratio Q of the latent heat of evapotranspiration to the available energy was obtained. For pF between 2 and 3, Q = 0.6, and for pF more than 3, Q decreases exponentially when pF increases. For pF = 4.2, Q = 0.11. These and other empirical and theoretical results suggested that the Q-pF relationship can be useful for calculating evapotranspiration from complex terrain situations where the micrometeorological approach is inapplicable. (Sims-ISWS)
W79-06069

CLIMATOLOGICAL ESTIMATES OF LAKE EVAPORATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
F. I. Morton.
Water Resources Research, Vol. 15, No. 1, p 64-76, February 1979. 6 fig, 5 tab, 15 ref.

Descriptors: *Arizona, *Oklahoma, *California, *Nevada, *Canada, *Lake Ontario, Evaporation, *Energy budget, Climatology, Transpiration, Temperature, Humidity, Radiation, Environment, *Lake evaporation, *Areal evaporation, *Nile River, *Lake Hefner(CA), *Salton Sea, *Dauphin Lake(MB), *Lake Mead, Areal transpiration, Annual lake evaporation, Sunshine, Land environment.

A model for estimating areal evaporation and transpiration was modified slightly to provide estimates of annual lake evaporation from monthly observations of temperature, humidity, and sunshine duration (or radiation) in the land environment. The model estimates were higher than the more conventional estimates in humid areas and lower in arid areas, with the latter tendency particularly noticeable in the case of Lake Nasser on the Nile River. However, the results agreed very well with comparable water budget estimates for

Lake Hefner in Oklahoma, the Salton Sea and Silver Lake in California, Pyramid Lake in Nevada, Lake Ontario, and Dauphin Lake in Manitoba. The model results also compared reasonably well with energy budget estimates of the evaporation from Lake Mead on the border between Arizona and Nevada when the net inflow of heat was taken into account. A technique that provided such realistic results over a wide range of depths and environments with readily available data proved useful in water resource or environmental impact studies. Examples of such uses were provided by maps of Canada and the southeastern United States and showed average annual values of the lake evaporation, average values of the difference between the evaporation from a projected reservoir, and the combined evaporation and transpiration from the area before flooding. (Roberts-ISWS)
W79-06261

ROLE OF EVAPORATION IN SPRINGTIME RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE FOREST ZONE OF THE EUROPEAN USSR,
O. I. Krestovskiy, and A. G. Sergeyeva.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 93-97, 1977. 2 fig, 2 tab, 11 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 79-86, 1977.

Descriptors: *Evaporation, *Snowmelt, *Runoff, Floods, Melt water, Snow, Surface waters, Soil water, Drainage, Watersheds(Basins), Flood forecasting, On-site investigations, On-site data collections, Evaporation pans, Melting, Water loss, *USSR.

Evaporation during the spring flood takes place from the surface of the snow, from water at the surface of a basin, and from snow-free soil. Total evaporation from the date of establishment of the maximum water equivalent of snow to the date of snow disappearance, i.e., during the period of runoff formation at the surface of drainage basins, averages 30-50 mm in the lowland area of the forest zone of the European USSR and varies by years and basins from 15 to 60 mm. Evaporation accounts for 30-60% of the total spring water losses, or 15-25% of the total water equivalent by the beginning of snow melting and precipitation during the runoff-forming period in spring. Daily total evaporation from more than 30% wooded basins averages about 1.0 mm/day and varies little from year to year. Therefore, total evaporation is determined in many respects by the duration of the runoff-forming period, i.e., the period of snow melting in forests, which depends to a large extent on the water equivalent. The presence of an indirect relation between total evaporation and the water equivalent of snow makes it possible to precalculate water losses through evaporation. In existing methods for the long-range forecasting of the spring runoff volume, the losses of water through evaporation are taken into account automatically, since the water equivalent of snow is the main argument in all prognostic relations. (Sims-ISWS)
W79-06409

NEW EVALUATION OF THE ADVISABILITY OF SEPARATING THE EASTERN SHALLOWS OF THE NORTHERN CASPIAN,
Akademiya Nauk SSSR, Moscow. i Inst. Geografii.
R. V. Nikolayeva, and R. Ye. Pereslegina.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 163-168, 1977. 9 tab, 18 ref. Translated from Izvestiya Akademii Nauk SSR, Seria Geograficheskaia, No 6, p 49-56, 1977.

Descriptors: *Water loss, *Evaporation, *Shallow water, Coasts, Wind tides, Winds, Water levels, Precipitation(Atmospheric), Hydrologic budget, Dams, Wetlands, *USSR, *Caspian Sea.

From refined computations of irreversible water losses through evaporation from the temporarily flooded coastal belt and from estimates of the possible savings in the hydrologic budget of the sea after separation of the shallows, it was concluded that it is inadvisable to construct dams to reduce the water area of the Northern Caspian. (Sims-ISWS)
W79-06413

A PARAMETERIZATION OF THE EVAPORATION FROM NONSATURATED SURFACES,
Commonwealth Scientific and Industrial Research Organization, Mordialloc (Australia). Div. of Atmospheric Physics.
I. J. Barton.
Journal of Applied Meteorology, Vol 18, p 43-47, January 1979. 2 fig, 15 ref.

Descriptors: *Parametric hydrology, *Evaporation, *Surfaces, Radiation, Moisture content, Temperature, Air temperature, Variability, Moisture, Soil moisture, *Unsaturated surfaces, Net radiation, Constants, Variables, Moisture availability, Open grassland surfaces, Near-surface soil moisture.

The parameterization of evaporation proposed by Priestley and Taylor was modified to take account of nonsaturated surfaces. It was suggested that evaporation could be expressed as a function of net radiation, air temperature, a constant related to the nature of the surface, and a variable that was dependent on moisture availability. The constant was equal to 1.26 for water and open grassland surfaces, but was nearer unity for some other surfaces. The variable was found to be directly related to near-surface soil moisture content for both bare and grassland surfaces. (Roberts-ISWS)
W79-06422

2E. Streamflow and Runoff

FORECASTING SEASONAL SNOWMELT RUNOFF: A SUMMARY OF EXPERIENCE WITH TWO MODELS APPLIED TO THREE DRAINAGES IN THE CASCADE MOUNTAINS OF WASHINGTON,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and T. J. Waddle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 656, Price codes: A06 in paper copy, A01 in microfiche. Charles W. Harris Hydraulics Laboratory Technical Report No. 59, November 1978. 104 p, 27 fig, 8 tab, 29 ref. OWRT B-071-WASH(2). 14-34-0001-7199.

Descriptors: *Runoff forecasting, *Snowmelt, Stochastic hydrology, Optimization, Reservoir operation, Watersheds.

Two alternative approaches to forecasting seasonal runoff volumes from watersheds with substantial snow storage were investigated. In the first, a continuous simulation model developed by the National Weather Service River Forecast Center in Sacramento, California was applied to the Cedar River, Washington. Although the model had proved quite successful in forecasting runoff from several California Sierra Nevada streams, the model could not be successfully calibrated for use in forecasting Cedar River runoff. Problems were traced to the snowpack accumulation and ablation module of the model; adequate performance of the land module was observed as evidenced by successful simulation of runoff events during seasons of the year with minimum snow water storage. The principal difficulties with the snowpack module appeared to be (1) use of the saturated adiabatic lapse rate for temperature computation regardless of weather conditions, (2) an unrealistically low partition temperature for discrimination between precipitation falling as rain and snow, (3) the method of computation of cloud cover for modification of solar radiation reaching the snowpack, (4) unrealistically low wind movement required to calibrate the condensation melt portion of the snowpack module, and (5) possible underestimation of the free water retention in the snowpack. The second approach employed was a modification of Tangborn's (1977) basin storage accounting approach, in which parameters are estimated by regression. The model was applied to three Washington streams: the Cedar, American and Stehekin Rivers. Inclusion of the snow course data substantially improved the accuracy of the Cedar River forecasts, substantially decreased the accuracy of the Stehekin River forecasts, and made little difference to the American River forecasts. Forecasts had little value beyond about March 15 for all the basins and had negative value to the Stehekin River forecasts. Increased precipitation forecast worth was observed for early winter runoff forecasts.
W79-06047

INCORPORATION OF FORECASTED SEASONAL RUNOFF VOLUMES INTO RESERVOIR MANAGEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. J. Burges, and K. Hoshi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 655, Price codes: A05 in paper copy, A01 in microfiche. Charles W. Harris Hydraulics Laboratory Technical Report No. 58, November 1978. 92 p, 7 fig, 8 tab, 65 ref. OWRT B-071-WASH(1). 14-34-0001-7199.

Descriptors: *Snowmelt, Stochastic hydrology, Optimization, Reservoir operation, *Runoff forecasting, Regression analysis.

The forecasting approaches can be classified as regression methods, pseudo water balance methods, and water balance methods. The major effort of this report focused on disaggregating predicted total seasonal runoff volumes to yield conditional probability distributions of flow in each month of the total forecast period. These conditional distributions were used as principal input data to a reservoir operation model. Forecasts of total snowmelt seasonal runoff volumes were used to determine operating rules for hypothetical reservoirs to determine the relative advantage of using forecasted flow over the unconditional flow state. Comparisons were made using chance constrained linear programming (CCLP) formulations for the operation of a single multiple purpose reservoir with and without snowmelt runoff forecasts. Two reservoir sizes, one approximately 20% and the other 100% of the mean annual flow volume of a river, were examined. Flow data from the Cedar River, Washington, were used to reflect runoff patterns typical of much of the Pacific Northwest region. Conditional streamflow distributions for months March-August were developed for given total March-August runoff volume amounts. These conditional distributions were used to develop Linear Decision Rules (LDR's) for the release from the reservoir. Economic benefits were computed for maximum ignorance operating rules (Type A), Type A operating rules with conditional inflows (Type B) and LDR's and benefits based on the conditional flows (Type C). Generally, under Type C operation there was less uncertainty in the cumulative distributions of water supply and reservoir freeboard (surrogate for flood control) than when Type A operation was used.
W79-06048

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, I. THEORY,
Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia).
For primary bibliographic entry see Field 5B.
W79-06065

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, II. APPLICATION TO EXPERIMENTAL RESULTS,
Commonwealth Scientific and Industrial Research Organization, North Ryde, (Australia).
For primary bibliographic entry see Field 5B.
W79-06066

AN OBJECTIVE CRITERION FOR THE SELECTION OF REPRESENTATIVE BASINS,
Ibadan Univ. (Nigeria). Dept. of Geography.

F. S. Ebisemiju.
Water Resources Research, Vol. 15, No. 1, p 148-158, February 1979. 6 fig, 5 tab, 28 ref.

Descriptors: *Watersheds(Basins), *Africa, *Basins, *Drainage patterns(Geologic), *Geomorphology, Rivers, River basins, Drainage, Geology, Channel morphology, Channels, Classification, Hydrology, *Nigeria.

The existence of a hydrologically uniform area is questionable. Therefore, it is unlikely that a drainage basin can truly represent the diverse environmental and terrain conditions in any given area. The widely documented strong association between basin morphometry and hydrological responses indicates the possibility of identifying hydrologically similar basins on the basis of similarity of their gross morphology. By using a multidimensional, morphological classification of drainage basins, a rational basis for the selection of representative basins was developed. The procedures for this classification and selection were outlined and illustrated with an example from southeastern Nigeria. (Sims-ISWS)
W79-06070

ENTROPY CONCEPTS IN FLUVIAL GEOMORPHOLOGY: A REEVALUATION,
Lincoln College, (New Zealand). Tussock Grasslands and Mountain Lands Inst.
B. W. Davy, and T. R. H. Davies.
Water Resources Research, Vol. 15, No. 1, p 103-106, February 1979. 1 fig, 25 ref.

Descriptors: *Geomorphology, *Entropy, *Analytical techniques, *Fluvial sediments, Meanders, Channels, Channel morphology, Thermodynamics, Data processing, Mathematical models, Hydrology, Fluvial geomorphology.

The thermodynamic basis of entropy concepts as applied in fluvial geomorphology was examined closely. It was shown that the principle of minimum entropy production rate and the principle that the most probable state of a system is that which corresponds to a maximum of entropy are not applicable in stream situations. It was concluded that the use of entropy as an approach to stream behavior and sediment transport is of dubious validity. (Sims-ISWS)
W79-06074

DISSOLVED IRON--AN INDICATOR OF THE GROUNDWATER COMPONENT OF SMALL STREAMS DRAINING A GRANITE TERRAIN, SOUTH CAROLINA,
South Carolina Univ., Columbia. Dept. of Geology.
I. Kheoruenromne, and L. R. Gardner.
Water Resources Research, Vol. 15, No. 1, p 15-20, February 1979. 5 fig, 1 tab, 19 ref.

Descriptors: *Dissolved solids, *Iron, *Streams, *Groundwater, *South Carolina, On-site data collections, Model studies, Mathematical models, Streamflow, Runoff, Groundwater movement, Forests, Vegetation, Vegetation effects, Flow, Temporal distribution, Water quality, Hydrology.

The flow and dissolved iron content of two small streams draining a woodland basin and a recently deforested basin on a granite pluton in Kershaw County, South Carolina, were measured biweekly from September 1974 through August 1975. During spring and summer, the flow of the stream draining the deforested basin was reduced relative to that of the woodland basin because of the higher transpiration associated with rapid biomass accumulation by the newly established vegetation in the deforested basin. The observed relative reduction in flow was accompanied by a relative increase in iron concentration in the flow from the deforested basin. Analysis of the data also indicated that the rate of export of dissolved iron from both basins is independent of stream discharge. These observations suggested that the dissolved iron content of these streams is controlled by the dilution of iron-rich groundwater by essentially iron-free surface runoff and shallow interflow. A simple mixing model based on this hypothesis was developed and was found to fit the data. (Sims-ISWS)
W79-06078

CONSTRUCTION OF MODELS FOR FORECASTING AND CONTROLLING WATER QUALITY IN A RIVER BASIN ON PRINCIPLES OF SELF-ORGANIZATION,
Akademiya Nauk URSR, Kiev. Inst. Kibernetiki.
A. G. Ivakhenko.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 127-152, September 1978. EPA-600/9-78-024. 4 fig, 11 tab, 32 ref.

Descriptors: *River basins, *Forecasting, *Water quality, *Mathematical models, *Self-organization, *River flow, Annual, Monthly, Regression analysis, Equations, Systems analysis, Chlorides, Dissolved oxygen, Management, Reservoirs, Optimization, Discharge(Water), Harmonic trend, Optimum complexity, Dnieper River(USSR), Lagrangian polynomial, Linear polynomial.

The purpose of the research reported herein is to create mathematical models which adequately describe the dynamics of river basins and which are applicable both for forecasting and for deliberately changing and controlling the basins. Self-organization methods are considered the most promising mathematical models for identifying and controlling such systems. Work in this field from 1971 to 1975 was conducted at the Institute of Cybernetics of the Academy of Sciences, of the Ukraine. Construction of forecasting models for river basins developed for management purposes was also obtained at the VNIIVO Institute of the USSR Ministry of Land Reclamation and Water Use. Considered herein are: synthesis of models of the principle of self-organization; mathematical models for forecasting river flow; long-term forecast of the average annual flow of the Dnieper River; mathematical models for forecasting the quality of river water; and methods of managing the discharge of power plant reservoirs. Examples of methodological application are given, including forecasting of river flow with accuracy around 20%. Synthesis of the dynamics equations of the hydroelectrical power station discharge water reservoirs and the loss functions are shown. The equations obtained were used for synthesis of two-criteria management of the hydroelectric power station discharge in accordance with the ideas of multicriteria optimization. (See also W79-06166) (Bell-Graf--Cornell)
W79-06171

APPLICATIONS OF RECURSIVE ESTIMATION TECHNIQUES TO TIME VARIABLE HYDROLOGICAL SYSTEMS,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead.
Journal of Hydrology, Vol. 40, No. 1/2, p 1-16, January 1979. 5 fig, 1 tab, 16 ref.

Descriptors: *Time series analysis, *Methodology, *Model studies, *Hydrologic systems, Rainfall-runoff relationships, River systems, Hydrology, Optimization, Equations, Mathematical models, Rivers, Algorithms, *Recursive estimation techniques, Time variable hydrological system, Maximum likelihood algorithms.

A flexible methodology was illustrated. The methodology used the recursive instrumental variable approximate maximum likelihood algorithms of time-series analysis to identify parameter variations and to characterize time-varying hydrological systems. The approach was developed for a single-input--single-output rainfall--runoff process and was extended to the multivariable situation for a river water quality system. (Lee-ISWS)
W79-06251

MODELING ALLUVIAL CHANNEL BED TRANSIENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-06252

EFFICIENT SIMULATION OF NONLINEAR STEADY FLOW,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
G. Niemeyer.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14420, p 185-195, March 1979. 3 fig, 12 ref, 2 append. NSF DES74-23005.

Descriptors: *Steady flow, *Rivers, *Model studies, Mathematical models, Computer models, Computer programs, Simulation analysis, Numerical analysis, Hydrodynamics, Finite element analysis, Equations, Flow, Hydraulics.

Numerical simulation of steady flow can require considerable computation. However, unique features of finite element and finite difference methods can be exploited, which leads to an efficient solution procedure. Although the resulting technique is fundamentally a time-stepping method, it achieves convergence within only a few steps. The considerable computational advantages of the method were obtained, moreover, without sacrificing the rigor of the governing equations, which were solved in their full nonlinear form. The technique was developed specifically for the vertically integrated Navier-Stokes equations. It was applied to simulate steady river flow. (Sims-ISWS)
W79-06253

INSTANTANEOUS UNIT HYDROGRAPH WITH NEGATIVE ORDINATES--POSSIBLE,
Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
A. Boneh, and A. Golan.
Water Resources Research, Vol 15, No 1, p 121-130, February 1979. 7 fig, 21 ref.

Descriptors: *Unit hydrographs, *Runoff, *Hydrology, Hydrography analysis, Equations, Mathematical studies, Mathematics, Surface runoff, Flow, Time, Precipitation excess, Storm runoff.

The answer to the question posed in the title of this paper is yes, provided that some restrictions are imposed on the rainfall excess which is the input to the surface runoff system. Obviously, impulsive inputs are not admissible when the instantaneous unit hydrograph (IUH) has negative ordinates, since the IUH is the direct surface runoff response (known as the 'output') to an instantaneous rainfall burst of unit volume and such runoff, by definition, cannot be negative. Is an instantaneous unit hydrograph with negative ordinates (IUHWNO) desirable. Now the answer is no, because of the restrictions that have to be imposed on the input. The purpose of this paper was not to justify the assumption of linearity, an assumption which is open to serious doubts, but rather to point out that IUHWNO can be of value if and when linearity of surface runoff systems is assumed. Two problems were considered: (1) The first is the ability of an IUHWNO to represent a real-world surface runoff system. A 'degenerate IUH' does not have this ability, and hence the term 'nondegenerate IUH' was carefully defined in the paper. Several conditions were derived in the paper which enable decision as to the degeneracy of a given IUHWNO. (2) The second problem is the determination of the class of admissible inputs in a surface runoff system which is represented by a given nondegenerate IUHWNO. These two problems are relevant to whether or not one should explicitly introduce nonnegativity sign constraints into the IUH ordinates in the identification of a surface runoff system from input-output records. Possible extensions to nonlinear and time-varying systems were considered in the paper for continuous or discrete-time systems. (Lee-ISWS)
W79-06257

A GEOMORPHIC MODEL FOR USE IN STREAMFLOW ROUTING,
Tennessee Valley Authority, Knoxville.
R. P. Betson.
Water Resources Research, Vol. 15, No. 1, p 95-101, February 1979. 4 tab, 24 ref.

Descriptors: *Streamflow, *Routing, *Geomorphology, *Model studies, Mathematical models, Regression analysis, Watersheds(Basins), Discharge(Water), Channels, Channel flow, Flow, Sediments, Sediment transport, Hydrology, Hydraulics.

Regression equations were presented for predicting parameters in the geomorphic equations that relate streamflow discharge at a site to channel width and cross-sectional area (from which velocity and hydraulic depth can be determined). Two measures were used in these regression equations, drainage area and channel slope, both of which were obtained from topographic maps. Regeneration and simulation tests at stream gage sites located in the Cumberland Plateau Physiographic Province indicated that at higher flows, this system of equations can predict width and area within about 25% about 2/3 of the time. These results appear to be comparable with or better than results that would normally be obtained from the reconnaissance field surveys normally used in streamflow routing for planning-level applications. (Sims-ISWS)
W79-06259

INITIAL EFFECTS OF CLEARCUT LOGGING ON SIZE AND TIMING OF PEAK FLOWS IN A SMALL WATERSHED IN WESTERN OREGON,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forest Sciences Lab.
R. D. Harr, and F. M. McCorison.
Water Resources Research, Vol. 15, No. 1, p 90-94, February 1979. 4 fig, 3 tab, 13 ref. NSF DEB74-20744 A06.

Descriptors: *Peak discharge, *Oregon, *Watersheds(Basins), *Lumbering, Forest watersheds, Snowmelt, Hydrology, Storm runoff, Model studies, Flow, Snow, Trees, *Clearcut logging.

Size of annual peak flow in a small watershed in western Oregon was reduced 32%, and average delay of all peak flows was nearly 9 hours following clearcut logging. Size of annual peak flows caused by rain with snowmelt was reduced 36%, and peak flows resulting from rain with snowmelt were delayed an average of nearly 12 hours following logging. Changes were attributed mainly to differences in short-term accumulation and melting of snow. No significant changes were detected in size or timing of peak flows that resulted from rainfall alone. (Lee-ISWS)
W79-06260

DESIGN MODEL FOR THERMAL EFFLUENTS IN RIVERS,
Italian Electrical Power Agency, Pisa. Thermal and Nuclear Research Centre.
For primary bibliographic entry see Field 5B.
W79-06267

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

LOW-FLOW FREQUENCY OF MINNESOTA STREAMS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06321

SPATIAL CORRELATION OF HYDROLOGIC AND PHYSIOGRAPHIC ELEMENTS,
Swedish Meteorological and Hydrological Inst., Norrkoping.
L. Gottschalk.
Nordic Hydrology, Vol 9, No 5, p 267-276, 1978. 2 fig, 8 ref.

Descriptors: *Hydrologic aspects, *Physiographic provinces, *Correlation analysis, *Model studies, Mathematical models, Rivers, Flow, River flow, Topography, Precipitation(Atmospheric), Runoff, Drainage, Hydrology.

In an earlier paper analytical expressions were given for the time correlation of hydrologic processes from the linearized equations of motion for these processes. In this paper, space correlation was treated similarly. Comparison was made with empirical space correlation functions of hydrologic and physiographic elements. (Sims-ISWS)
W79-06405

THE WATERSHED INFLUENCE ON STORM RUNOFF IN SMALL NORWEGIAN RIVERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 2A.
W79-06406

THE DYNAMICS OF A DRAINAGE NETWORK,
Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-06407

COMPUTATION AND FORECAST OF THE SPRINGTIME FLOOD VOLUME IN THE VYATKA RIVER,
O. I. Krestovskiy.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 87-92, 1977. 3 fig, 2 tab, 7 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No 233, p 15-26, 1977.

Descriptors: *Runoff, *Floods, *Flood forecasting, *Model studies, Mathematical models, Snowmelt, Precipitation(Atmospheric), Spring, Melt water, Soil water, Rivers, Forecasting, Flow, Flood discharge, *USSR, *Vyatka River(USSR).

A method for computing and forecasting springtime water losses and runoff depth during the flood period and the second quarter for the Vyatka River basin was described. It was developed on the basis of network observations of the Hydrometeorological Service over the period of 1936-1974. The proposed method is effective and based on the use of the autumn-winter river runoff and the depth of soil freezing in the field as indicators of the water storage capacity of the basin in spring. However, use of normal precipitation instead of actual precipitation for runoff forecasting reduces the effectiveness of the proposed method, since precipitation during the snow melting period can be smaller or greater by a factor of 5 than normal precipitation and runs off the entire basin with a runoff coefficient of 0.8-1.0. Therefore, the further improvement of forecasts of the spring runoff volume of the Vyatka River must be directed toward improving the method of forecasting spring precipitation. (Sims-ISWS)
W79-06408

ROLE OF EVAPORATION IN SPRINGTIME RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE FOREST ZONE OF THE EUROPEAN USSR,
For primary bibliographic entry see Field 2D.
W79-06409

ESTIMATION OF THE ERROR IN THE DETERMINATION OF SOIL WATER STORAGE AT OBSERVATION POINTS,
For primary bibliographic entry see Field 2G.
W79-06410

ROLE OF HYDROPHYSICAL SOIL PROPERTIES IN SPRING FLOOD RUNOFF LOSSES,
For primary bibliographic entry see Field 2G.
W79-06411

RUNOFF-REGULATING PROPERTIES OF DRAINED FORESTS IN LATVIA,
Latvial Scientific Research Inst. of Forest Management Problems (USSR).
A. A. Ayre.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 173-175, 1977. 3 fig, 1 tab, 6 ref. Translated from Lesovedeniye, No 5, p 67-71, 1977.

Descriptors: *Runoff, *Drainage, *Forests, Soils, Soil types, Peat, Ditches, Rainfall, Precipitation(Atmospheric), Surface drainage, Trees, Forestry, *USSR, *Latvia.

The results of investigations of the runoff regime in the drained forests of Latvia were examined. The data obtained in small wooded drainage basins indicated that the relatively thin network of shallow ditches used at the present time to drain the forests does not cause adverse changes in river runoff. As compared to drained forests on hydromorphic mineral soils, the flood runoff from drained forests on peat soils is smoother, higher during the low-flow period, and more sustained. (Sims-ISWS)
W79-06414

FIELD PROCEDURES AND EVALUATION OF A SLUG DILUTION GAUGING METHOD IN MOUNTAIN STREAMS,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W79-06415

INDUCED CHANNEL INSTABILITY AND HYDRAULIC GEOMETRY OF THE MANGAWHARA STREAM, NEW ZEALAND,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
J. R. Bennett, and M. J. Selby.
Journal of Hydrology (New Zealand), Vol 16, No 2, p 134-147, 1977. 4 fig, 5 tab, 24 ref.

Descriptors: *Channel morphology, *Watersheds(Basins), *Streams, *Streamflow, Rivers, Channels, Hydraulic gradient, Erosion, Sedimentation, Forests, Pastures, Grasslands, Banks, Stability, Slope, Width, Meanders, Hydraulics, Hydrology, *Mangawhara Stream(New Zealand), *New Zealand, Forest clearing effects.

Approximately 50% of the Mangawhara catchment has been converted from forest to pasture in the last 50 years. Streamflow is now more responsive to intense rainfalls, and the supply of bedload to the channel has increased as a result of landsliding on the slopes. It has been suggested that increases in bedload and water discharge will be accompanied by increases in channel width, meander wavelength, and width-depth ratio and by a decrease in sinuosity. Changes in gradient and depth may be in either direction. For the Mangawhara, all recorded changes are as suggested, while both gradient and depth changes are small and of uncertain direction. Measures of the hydraulic geometry both at-a-station and downstream obey the laws established for rivers elsewhere. (Sims-ISWS)
W79-06416

WATER TEMPERATURES OF THE NGARURORO RIVER AT THREE STATIONS,
Ministry of Works, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
Journal of Hydrology (New Zealand), Vol. 16, No. 2, p 148-157, 1977. 7 fig, 3 tab, 1 ref, 1 append.

Descriptors: *Water temperature, *Rivers, *Streamflow, Sampling, Measurement, On-site investigations, On-site data collections, Data processing, Correlation analysis, Regression anlysis, Temperature, Air temperature, Monthly, Foreign countries, Foreign research, Climatology, Hydrology, *New Zealand, *Ngaruroro River(New Zealand), *Kuripapango(New Zealand), *Whanawhana(New Zealand), *Fernhill(New Zealand).

From 349 random measurements of water temperature during 1961-76 at Kuripapango, Whanawhana, and Fernhill on the Ngaruroro River, it was found that both mean monthly and mean maximum monthly water temperatures at each station followed an annual cycle with respective amplitudes of about 12 C and 15 C, and they correlated highly with mean monthly air temperature at Napier. The number of months during which stated water temperatures may be exceeded at each station increased in the downstream direction. A 5-month thermographic record of water temperature supplemented random measurements to define the high temperature limits at Fernhill in relation to flow rates. Highest water tempertures are likely to occur in the 10-20 cu m/s flow range, and the indication was that below 10 cu m/s, the water temperatures decrease rather than increase. This phenomenon is probably the effect of channel underflows and is reinforced during recession by base flow. A temperature duration pattern and models for the prediction of daily maximum and daily minimum water temperatures at Fernhill were given. (Sims-ISWS)
W79-06417

FLOW MEASUREMENT USING A CONDUCTIVITY FLOW METER--INITIAL INVESTIGATION,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 7B.
W79-06419

STATISTICAL ANALYSIS OF SEDIMENT MOTIONS OF DUNES,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 2J.
W79-06421

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-06423

2F. Groundwater

BASIC HYDROGEOLOGY - GLACIAL DEPOSITS AS AQUIFERS,
For primary bibliographic entry see Field 2J.
W79-06013

DATING GROUND WATER.
Ground Water Age, Vol. 12, No. 11, p 29-30, July, 1978.

Descriptors: *Radioactive dating, *Ground water, Radioisotopes, Australia, Groundwater movement, Groundwater recharge, Groundwater mining, Groundwater basins, Deep percolation, Artesian aquifers, Desertification, Water management(Applied).

Radioisotope dating of ground water in Australia's Great Artesian Basin indicates that ground water is moving southwest towards south Australia at the rate of about one meter per year. If water from artesian wells is thousands of years old it will not be replenished rapidly enough to compensate for its withdrawal and is, in effect, being mined. Thus, dating of ground water can be a tool in ground water management and can help avoid desertification in areas such as Australia. (Purdin-NWWA)
W79-06016

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 067, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/9-76-011, May 1976. Proceedings of a Workshop held October 20-21, 1975, Las Vegas, Nevada. 244 p.

Descriptors: *Geothermal studies, *Monitoring, *Sampling, *Thermal water, Steam, Pollutants, Gases, Chemicals, Water chemistry, Water quality, On-site investigations, On-site data collections, Data processing, Effluents, Brines, Radioisotopes, Groundwater, Wells, Water wells, Springs, Equipment, Instrumentation, Analytical techniques, Methodology, *Geothermal energy.

This was a compilation of papers presented at the first in a series of workshops on environmental monitoring of geothermal energy development held on October 20 and 21, 1975, at the Environmental Protection Agency's Environmental Monitoring and Support Laboratory in Las Vegas, Nevada. The purpose of this workshop was to generate the exchange of ideas and knowledge needed to develop a set of standard geothermal sampling methods with assurance of quality in those methods. Representatives of industry, universities, and government presented 19 technical papers, 12 of which were published in this document. Their content and the discussions which followed the presentations provided guidance for developing a recognized Referenced Sampling Method Handbook. (See W79-06053 thru W79-06064) (Sims-ISWS)
W79-06052

GEOTHERMAL ENERGY DEVELOPMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
P. Kruger.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 1-35, May 1976. 7 tab, 12 ref.

Descriptors: *Thermal water, *Geothermal studies, *Energy, Projects, Research and development, Heat, Temperature, Heated water, Groundwater, Water quality, Reviews, Geothermal energy, Energy resources.

The Nation has embarked on an aggressive program to develop its indigenous resources of geothermal energy. For more than a decade, geothermal energy has been heralded as one of the more promising forms of energy alternate to oil and gas for electric power generation, but during the last 15 years, the total capacity in the U.S. has reached 502 MWe, about half the size of a single modern nuclear power plant. The upper 10 km of the earth's crust may contain more than 3 x 10 to the 26th power cal of heat, a resource base readily classified as vast. However, much of this energy is too diffuse to be exploitable as an energy source. Geothermal resources may be defined as localized deposits of geothermal heat concentrated at attainable depths, in adequate volumes, and at temperatures sufficient for commercial exploitation. The National Geothermal Program was described. (See also W79-06052) (Sims-ISWS)
W79-06053

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SOME PROBLEMS INVOLVED WITH SAMPLING GEOTHERMAL SOURCES,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 5A.
W79-06055

DRILL STEM TESTING AND SAMPLING OF GEO-PRESSURED BRINES,
Halliburton Services, Duncan, OK.
For primary bibliographic entry see Field 5A.
W79-06056

THE SALINITY PROFILE OF THE EAST MESA FIELD AS DETERMINED FROM DUAL INDUCTION RESISTIVITY AND SP LOGS,
Bureau of Reclamation, Boulder City, NV. Region 3.
R. T. Littleton, and E. E. Burnett.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 114-125, May 1976. 9 fig.

Descriptors: *Geothermal studies, *Thermal water, *Salinity, Wells, Water wells, Density, Brines, Salts, Electrical conductance, Water quality, Porosity, Groundwater, On-site investigations, Drill stem testing.

In a water-dominated geothermal reservoir such as the East Mesa Field, it is practical to obtain the general dimensions of dissolved mineral concentration by interpretation of dual induction resistivity logs and self-potential logs. Values so obtained may be substantially greater or less than those obtained by laboratory analyses of water samples from the same zones. Therefore, it is necessary to establish calibrating coefficients by borehole sampling and laboratory analyses. (See also W79-06052) (Sims-ISWS)
W79-06057

FIELD SAMPLING OF RADIOACTIVE GEOTHERMAL EFFLUENTS,
LFE Environmental Analysis Labs., Richmond, CA.
A. J. Soinski, D. E. Claridge, and R. Melgard.
In: Proceedings of the Firt Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 126-142, May 1976. 3 fig, 3 tab, 17 ref, 1 append.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Sampling, *California, On-site investigations, On-site data collections, Radioisotopes, Radium radioisotopes, Powerplants, Water, Gases, Geysers, Hydrogen sulfide, Chemicals, Analytical techniques, Methodology, *The Geysers(CA), Fumaroles, Radon.

A sampling program for radioactive effluents from The Geysers geothermal power plant was described. Radon-222 was sampled both in the noncondensable fraction of geothermal steam and in the atmosphere. A variety of solid and liquid matrices, including steam condensate, cooling tower sludge, soil, and grass, were sampled and analyzed for 226Ra and 210Pb. The three radioactive isotopes 222Rn, 226Ra, and 210Pb are members of the naturally-occurring 238U radioactive decay chain. Stack sampling techniques were applied to the collection of steam, and a simple sampling train was constructed to separate and collect the condensable and non-condensable fractions. Collection techniques for selected solid and liquid matrices were described. Two complicating factors in the sampling and analysis program were addressed: the collection of atmospheric samples for radon from a local source in the presence of the natural background, and the long-term temporal variation in the emission rate of contaminants from a geothermal field. The sampling and analytical methods used were capable of detecting 222Rn, 226Ra, and 210Pb at environmental concentrations that are below the allowable maximums set in State of California regulations. (See also W79-06052) (Sims-ISWS)
W79-06058

ATMOSPHERIC DISCHARGE SAMPLING WHILE DRILLING GEOTHERMAL STEAM WELLS,
Frederiksen Engineering Co., Oakland, CA.
M. H. Hyman, and G. R. Fox.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 175-180, May 1976. 2 fig.

Descriptors: *Geothermal studies, *Steam, *Sampling, Gases, Suspended solids, Separation techniques, Air pollution, Pollution abatement, Pollutants, Hydrogen sulfide, Mercury, Ammonia, Drilling, Wells, Noise, Scrubbers, Steam wells.

During the final phases of drilling live geothermal steam wells, considerable amounts of particulate (rock dust) and vapors are discharged. Abatement of particulates, gases, and noise was accomplished with water injection and utilization of centrifugal separators. A special method of sampling for particulates while drilling, even when active steam formations are encountered, was proved to be successful. The sampling train employed also was useful for source testing of hydrogen sulfide, mercury vapor, and ammonia. (See also W79-06052) (Sims-ISWS)
W79-06059

SAMPLING HOT SPRINGS FOR RADIOACTIVE AND TRACE ELEMENTS,
California Univ., Berkeley. Lawrence Berkeley Lab.
H. A. Wollenberg.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 143-164, May 1976. 17 fig, 5 ref.

Descriptors: *Geothermal studies, *Thermal water, *Springs, *Sampling, Radioisotopes, Uranium, Trace elements, X-ray fluorescence, Chemicals, Analytical techniques, On-site investigations, On-site data collections, Groundwater, Radon.

The techniques described have proved successful in obtaining samples of hot and cold spring waters for x-ray fluorescence, neutron activation, and radiometric analyses. These sampling methods require only lightweight, portable field apparatus, and do not involve lengthy collection procedures. Good flexibility in field operations is necessary to accommodate the widely varying conditions of temperature, flow, and accessibility encountered at the different spring sites. (See also W79-06052) (Sims-ISWS)
W79-06060

UNION OIL COMPANY OF CALIFORNIA'S GEOTHERMAL SAMPLING TECHNIQUES,
Union Oil Co. of California, Brea.
D. J. Christofferson, R. N. Wheatley, and J. A. Baur.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 165-173, May 1976. 8 fig.

Descriptors: *Geothermal studies, *Sampling, *Chemical analysis, *Steam, Chemicals, Gases, Analytical techniques, Methodology, Ammonia, Methane, Nitrogen, Hydrogen sulfide, Carbon dioxide, Equipment, Instrumentation.

The purpose was to describe the procedures used by Union Oil Company to sample and analyze produced geothermal steam for total composition. As is the case in any analytical problem, representative, accurate sampling is essential to the problem solution. Sampling-produced geothermal steam is no exception to this rule. The sample matrix that was dealt with was mainly water; and an analysis was done for gaseous and other compounds, some of which are highly soluble in water and some of which are relatively insoluble. The sampling and analysis for these compounds were described. (See also W79-06052) (Sims-ISWS)
W79-06061

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
J. H. Hill, and C. J. Morris.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 181-203, May 1976. 2 fig, 6 tab, 2 ref. ERDA W-7405-Eng-48.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Sampling, Brines, Chemicals, Chemical analysis, Hydrogen ion concentration, Oxidation-reduction potential, Dissolved solids, Suspended solids, Carbon dioxide, Sulfur, Cations, Anions, Salts, Calcium, Groundwater.

This report described an experiment designed primarily to define the problems associated with sampling the two-phase flow in a pipeline of geothermal brine. Analyses reported for 26 samples included chemical composition, oxidation potential, pH, density, and total solids. Changes in brine composition as the well operated during a 4-week period were evaluated. The apparatus and techniques used for sampling were described and evaluated. (See also W79-06052) (Sims-ISWS)
W79-06062

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
J. W. Ball, E. A. Jenne, J. M. Burchard, and A. H. Truesdell.
In: Proceedings of the First Workshop on Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 218-234, May 1976. 7 fig, 10 ref.

Descriptors: *Geothermal studies, *Sampling, *Chemical analysis, Preservation, Geysers, Springs, Thermal waters, Gases, Chemicals, Hydrogen ion concentration, Oxidation-reduction potential, Temperature, Dissolved oxygen, Silica, Instrumentation, Equipment, Water chemistry, *Sample preservation.

Sampling of geothermal fluids presents unique challenges due to the instability and wide concentration range of many constituents. Unstable parameters, such as pH, Eh, temperature and dissolved oxygen, are determined on-site. Filtration of geothermal water is done with absolute minimum time-delay and exposure of the sample to air, by using a portable pump and non-contaminating, all-plastic or all-metal filter apparatus, for samples for inorganic or organic determinations, respectively. Sample preservatives and their safe, efficient transportation were discussed. Two techniques of geothermal gas collection were presented along with details of gas sampling apparatus. (See also W79-06052) (Sims-ISWS)
W79-06064

DETERMINATION OF THE MECHANISM OF RECHARGE IN THE LOS NARANJOS AREA IN MEXICO USING ENVIRONMENTAL ISOTOPE TECHNIQUES,
International Atomic Energy Agency, Vienna (Austria).
B. R. Payne, and I. S. Ortiz.
Water Resources Research, Vol. 15, No. 1, p 171-175, February 1979. 2 fig, 1 tab, 3 ref.

Descriptors: *Isotope studies, *Groundwater recharge, *Rivers, *Mexico, Recharge, Natural recharge, Discharge(Water), Evaporation, Precipitation(Atmospheric), Runoff, Infiltration, Groundwater, Oxygen isotopes, Deuterium, Sampling, Data processing, *Mexico, *Rio Blancio(Mexico).

The Rio Blanco crosses a coastal plain south of Veracruz in Mexico, and discharge measurements suggested that the river is recharging the groundwater system. The estimated evapotranspiration is very close to the mean annual precipitation, so estimates of effective recharge by infiltration of precipitation are imprecise. The variations in the stable isotopic composition (D and 18 O) of surface and groundwater samples were used to estimate the relative importance of the two sources of recharge to the groundwater system. The data indicated that recharge by infiltration of precipitation is the dominant source of recharge. This conclusion was based upon measurements from individual wells and also on the base flow of rivers originating in the plain, thus providing an estimate integrated over the area drained by the rivers. (Sims-ISWS)
W79-06067

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W79-06071

DISSOLVED IRON--AN INDICATOR OF THE GROUNDWATER COMPONENT OF SMALL STREAMS DRAINING A GRANITE TERRAIN, SOUTH CAROLINA,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 2E.
W79-06078

THE GENERALIZATION OF DARCY'S LAW FOR NONUNIFORM FLOWS,
Tel Aviv Univ., (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol 15, No 1, p 1-7, February 1979. 1 fig, 12 ref.

Descriptors: *Darcys Law, *Porous media, *Soil water movement, *Model studies, Mathematical models, Equations, Flow, Soil water, Groundwater, Groundwater movement, Nonuniform flow, Mathematics, Analytical techniques.

A generalized Darcy's law for nonuniform flows in which the pressure gradient depends on the velocity and its derivatives was adopted. The permeability coefficient, as well as a new coefficient, was investigated with the aid of the averaged dissipation equation. The additional coefficient appearing in the generalized law was estimated with the aid of a cell model, and the generalized law was employed in order to solve a few problems (Couette flow past a porous boundary, refraction at the boundary between two porous samples, and flow around a thin partition). Deviations from Darcy's law were found to be confined to thin layers near the medium boundaries. (Sims-ISWS)
W79-06080

GROUNDWATER RECHARGE AND PALEOCLIMATE IN THE SIRTE AND KUFRA BASINS, LIBYA,
Institute of Geological Sciences, Wallingford (England).
W. M. Edmunds, and E. P. Wright.
Journal of Hydrology, Vol 40, No 3/4, p 215-241, February 1979. 6 fig, 4 tab, 31 ref.

Descriptors: *Groundwater recharge, *Paleoclimatology, *Stable isotopes, *Radioisotopes, *Groundwater basins, *Radioactive dating, *Africa, Age, Aquifers, Groundwater, Rainfall, Monsoons, Evaporation, Deserts, Arid climates, Water quality, Sampling, Freshwater, Foreign countries, Foreign research, *Libya, *Sirte Basin(Libya), *Kufra Basin(Libya).

Stable and radio-isotope results (C, H, O) for groundwaters from the Sirte and northern Kufra basins were used to determine the recharge history during the Holocene and late Pleistocene. Radiocarbon ages were corrected on the basis of their stable carbon isotope ratios and on environmental samples from the areas. Two groups may be recognized, (1) low 14C activity groundwaters (13000-34000 yr BP) with delta 13C -5.6 to -11.7 parts per thousand; and (2) higher 14C activity groundwaters (5000-7800 yr BP) enriched in 13C up to delta 13C = -3.2 parts per thousand. A well-defined freshwater (less than 50 mg/l Cl(-)) channel can be traced within the aquifer for some 130 km through the region, which is considered to represent recharge from a former wadi. This water, with an age of + or - 7800 yr BP, is chemically and isotopically distinct from the regional groundwaters and provides direct evidence of a significant recharge event during the Holocene. The stable isotope (O and H) composition of groundwater from the Kufra and Sirte basins are all related by an evaporative line with slope delta D = 4.5 delta 180 - 35 with an intercept on the meteoric line of -11 parts per thousand. The spatial and temporal distribution of groundwaters in rela-

tion to the evaporative line suggests a progressive change in character of the recharge, which is controlled by a shift towards strongly convective rainfall during the Holocene. (Visocky-ISWS)
W79-06249

ESTIMATING SEEPAGE FROM A RESERVOIR FROM CHANGE IN HYDRAULIC HEAD,
Science and Education Administration, Chickasha, OK.
J. W. Naney, and T. B. Thompson.
Journal of Hydrology, Vol. 40, No. 3/4, p 201-213, February 1979. 8 fig, 1 tab, 12 ref.

Descriptors: *Seepage, *Reservoirs, *Oklahoma, On-site data collections, Groundwater movement, Floodwater, Groundwater, Water levels, Dams, Structures, Hydrologic budget, Hydrogeology, Evaporation, Observation wells, Flow nets, Geology, Hydraulic head.

An investigation of seepage below floodwater-retarding structures resulted in a method for estimating seepage from a reservoir based upon change in head. A typical structure was selected for the study, and physiographic and geologic features of the site were identified. Extensive hydrologic and hydrogeologic data were collected and analyzed for the site. A major inflow event was recorded in the reservoir in September 1965, and data from that event were used to develop an equation for estimating the amount of seepage lost from the structure in relation to the hydraulic head behind the structure. The method presented by the authors provides a physically based method for estimating the impact of a reservoir on the groundwater flow system assuming variable reservoir head conditions. (Visocky-ISWS)
W79-06250

BOUNDARY SOLUTIONS TO TWO PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. L-F. Liu, and J. A. Liggett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY3, Proceedings Paper 14419, p 171-183, March 1979. 12 fig, 1 tab, 10 ref, 2 append. NSF ENG77-01479.

Descriptors: *Groundwater movement, *Porous media, *Groundwater recharge, *Model studies, Mathematical models, Numerical analysis, Groundwater, Recharge, Saturated flow, Boundary processes, Equations, Dams, Dikes, Soil surfaces, Soil water, Soil water movement.

The boundary integral equation method (BIEM) was used to solve free surface groundwater problems. The formulation included those problems in which the domain of the solution is infinite. Two methods were presented which treat infinite domains efficiently using the BIEM. These methods were illustrated by a two-dimensional recharge problem and by the flow through a dike on a pervious foundation. The BIEM solutions were compared to experimental data. Excellent agreement was observed. (Sims-ISWS)
W79-06254

A NOTE ON ESTIMATING FINITE DIFFERENCE INTERBLOCK HYDRAULIC CONDUCTIVITY VALUES FOR TRANSIENT UNSATURATED FLOW PROBLEMS,
Universite Scientifique et Medicale de Grenoble (France). Inst. de Mecanique.
R. Haverkamp, and M. Vanclin.
Water Resources Research, Vol 15, No 1, p 181-187, February 1979. 3 fig, 1 tab, 19 ref.

Descriptors: *Hydraulic conductivity, *Unsaturated flow, *Groundwater, *Model studies, Mathematical models, Groundwater movement, Flow, Infiltration, Soils, Soil water, Soil water movement, Moisture content, Hydrology, Finite difference methods.

Nine different methods of weighting interblock hydraulic conductivity values used for modeling one-dimensional water transfer in homogeneous, unsaturated soil were tested for their influence upon the accuracy of the finite difference solution. On the basis of these results, the most suitable weighting relation was selected. In a first stage, the numerical results obtained by the models using the various conductivity weighting formulas were compared with the quasi-analytical solution developed by Philip for a clay soil. In a second stage, the models were used to simulate a laboratory experiment carried out on a sandy soil. In both cases, rather drastic boundary conditions were applied. It appears clearly from these tests that the weighting errors are of critical influence on the accuracy of solution. As proposed in this note, the geometric mean taken over two adjacent hydraulic conductivity values is the only weighting method that generates little weighting error. The latter weighting relation was found to be preferable in terms of flexibility, precision, and feasibility. (Sims-ISWS)
W79-06255

UNSTEADY GROUNDWATER FLOW ON SLOPING BEDROCK,
Thessaloniki Univ., Salonika (Greece). Faculty of Technology.
C. N. Frangakis, and C. Tzimopoulos.
Water Resources Research, Vol 15, No 1, p 176-180, February 1979. 4 fig, 11 ref.

Descriptors: *Groundwater, *Unsteady flow, *Bedrock, *Model studies, Mathematical models, Groundwater movement, Discharge(Water), Flow, Slopes, Equations, Numerical analysis, Analytical techniques, Galerkin's method.

A numerical model based on the equation describing the unsteady groundwater flow on impervious sloping bedrock was formulated. The case which was studied concerned the groundwater flow from one canal to another with a sudden rising of the canal level as an upstream boundary condition, while the downstream level remained constant. Initially, at time $t = 0$, both levels were equal. The numerical model used the finite element technique with Galerkin's method. The stability and accuracy of the method were proven by comparison of numerical results with the Crank-Nicolson scheme. The algorithm developed for the finite element technique gave the same results as the one for the finite difference scheme. The effect of inclination of lower impervious boundary on outflow rate was studied. (Sims-ISWS)
W79-06256

MODELS OF GROUNDWATER FLOW IN STATISTICALLY HOMOGENEOUS POROUS FORMATIONS,
Tel Aviv Univ. (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol 15, No 1, p 47-63, February 1979. 7 fig, 13 ref, 1 append.

Descriptors: *Groundwater, *Groundwater movement, *Porous media, *Model studies, Mathematical models, Flow, Permeability, Storage, Soils, Soil water, Soil water movement, Hydraulic conductivity, Statistics, Statistical models, Stochastic processes, Steady flow, Unsteady flow, Pressure head, Soil science.

Most natural porous formations display significant variations in space of permeability, K, and storativity, S. Such formations are regarded as random structures characterized by the permeability frequency distribution and its autocorrelation. With the aid of three basic length scales (L sub 1, microscale; L sub 2, integral scale of K autocorrelation; and L sub 3, length scale of space change of average K) a classification of aquifers was suggested. A similar classification was proposed for the flow regimes. The study was limited to statistically homogeneous or slowly varying formations (L sub 2 much less than L sub 3) and to uniform or slowly varying (in space and time) flows. In the section dealing with steady flows, effective permeability, as well as variances of head gradient, specific discharge, and head, was computed for one-, two-, and three-dimensional flows. Bounds and an estimate of the effective permeability in terms of a log normal permeability distribution were given. The computations were based on physical, simplified models of formation structure. It was shown that the head variance is grossly overestimated for one-dimensional flow through blocks 'in series', and the same is true for specific discharge for layers 'in parallel'. The two- and three-dimensional variances are much lower and are close to each other. The unsteady flow was analyzed with the aid of the relaxation time needed for blocks of different K, S to adapt to the environment. For flows which change slowly and uniformly, the effective permeability is that derived for steady uniform flows, and the effective storativity is equal to the S arithmetic mean. The head gradient variance computed with the aid of some physical models was compared with that of steady uniform flow, and it was shown that for sufficiently slow time changes, the flow field can be considered momentarily uniform. (Sims-ISWS)
W79-06262

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W79-06295

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-06308

GROUND-WATER CONDITIONS IN THE NAVAJO SANDSTONE IN THE CENTRAL VIRGIN RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 6D.
W79-06310

INTERPRETATION OF WELL LOGS IN A CARBONATE AQUIFER,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-06312

HYDROLOGIC DATA, 1974-77, STOVEPIPE WELLS HOTEL AREA, DEATH VALLEY NATIONAL MONUMENT, INYO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-06313

FIELD VERIFICATION OF A ONE-DIMENSIONAL MATHEMATICAL MODEL FOR TRANSIENT COMPACTION AND EXPANSION OF A CONFINED AQUIFER SYSTEM,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06316

GROUND-WATER RESOURCES OF THE UPPER WINOOSKI RIVER BASIN, VERMONT,
Geological Survey, Boston, MA. Water Resources Div.; and Vermont Agency of Environmental Conservation. Dept. of Water Resources.
A. L. Hodges, Jr., R. E. Willey, J. W. Ashley, and D. Butterfield.
Geological Survey Water-Resources Investigations 77-120 (open-file report), 1977. 27 p, 3 fig, 4 plates, 7 tab, 17 ref.

Descriptors: *Groundwater resouces, *Aquifer characteristics, *Water quality, *Vermont, Water wells, Well data, Drillers logs, Pumping, Water yield, Hydrogeology, Groundwater recharge, Water levels, Hydrologic data, Groundwater availability, Hydraulic conductivity, Transmissivity, Chemical analysis, Maps, *Upper Winooski River basin(Vt).

Ground water in the upper Winooski River basin, Vermont, occurs in bedrock and in overlying unconsolidated deposits of glacial origin. Bedrock in the area is composed of a series of metamorphic and igneous rocks. Median yield for 126 wells in four different bedrock formations ranges from 5 to 6 gallons per minute, and median depth ranges from 130 to 200 feet. Lineaments, interpreted as fracture of breakage zones in bedrock, were mapped to identify zones where well yields are expected to be higher than average. Unconsolidated deposits in the upper Winooski River basin include unsorted till, water-sorted clay, silt, sand, and gravel. Properly constructed wells in saturated deposits of sand or gravel having high permeability can yield large quantities of water. Twenty-six domestic wells in these unconsolidated deposits have a median yield of 18 gallons per minute and a median depth of 58 feet. Chemical analysis of water from six wells indicate a median hardness of 120 milligrams per liter, (as CaCO3), which is moderately hard. Iron and manganese are common constituents of ground water in the area, and several analyses show concentrations of these elements which exceed recommended National Academy of Sciences and National Academy of Engineering (1973) limits for public drinking water supplies. (Woodard-USGS)
W79-06317

FINITE-ELEMENT ANALYSIS OF THE TRANSPORT OF WATER AND SOLUTES IN TILE-DRAINED SOILS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
J. F. Pickens, R. W. Gillham, and D. R. Cameron.
Journal of Hydrology, Vol. 40, No. 3/4, p 243-264, February 1979. 12 fig, 1 tab, 25 ref.

Descriptors: *Finite element analysis, *Groundwater movement, *Ion transport, Numerical analysis, Mathematical models, Solutes, Porous media, Saturated flow, Unsaturated flow, Tiles, Drains, Soils, Theoretical analysis, Water pollution, Leaching, Model studies, Galerkin technique, Solute transport.

The finite-element method based on a Galerkin technique was used to formulate the problem of simulating the two-dimensional (cross-sectional) transient movement of water and solute in saturated or partially saturated nonuniform porous media. The numerical model utilizes linear triangular elements. Nonreactive as well as reactive solutes whose behavior can be described by a distribution coefficient or first-order reaction term were considered. The flow portion of the model was tested by comparison of the model results with experimental and finite-difference results for transient flow in an unsaturated sand column, and the solute transport portion of the model was tested by comparison with analytical solution results. The model was applied to a hypothetical case involving movement of water and solutes in tile-drained soils. The simulation results showed the development of distinct solute leaching patterns in the soil as drainage proceeded. Although applied to a tile drainage problem in this study, the model should be equally useful in the study of a wide range of two-dimensional water and solute migration problems. (Visocky-ISWS)
W79-06393

SEMINUMERICAL SIMULATION OF SINGLY DISPERSIVE CONVECTION IN GROUNDWATER,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
H. Rubin.
Journal of Hydrology, Vol 40, No 3/4, p 265-281, February 1979. 5 fig, 22 ref, 1 append.

Descriptors: *Numerical analysis, *Convection, *Dispersion, *Groundwater, *Thermal water, Geothermal studies, Currents(Water), Water circulation, Mathematical models, Equations, Aquifers, Groundwater movement, Temperature, Model studies, *Israel.

Geothermal activity may lead to convection currents in groundwater. Such currents considerably affect transport phenomena in the aquifer. In this study, the applicability of a seminumerical approach for the simulation of flow conditions in such an aquifer was presented. Flow field variables are expanded through truncated sets of eigenfunctions, which leads to a system of general first-order differential equations that can be solved by applying available subroutines. Criteria of flow field stability, parameters affecting flow conditions, and quantitative analysis of transport processes in the aquifer were studied. (Visocky-ISWS)
W79-06394

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMENTAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
For primary bibliographic entry see Field 5B.
W79-06401

THE PHYSICS OF LONG TERM DRAWDOWNS IN PUMPING FROM ARTESIAN AQUIFERS,
TERRAQUA ApS, Kalundborg (Denmark).
H. Kaergaard.
Nordic Hydrology, Vol 9, No 5, p 249-262, 1978. 8 fig, 13 ref.

Descriptors: *Drawdown, *Pumping, *Aquifers, *Model studies, Mathematical models, Artesian aquifers, Aquitards, Storage, Leakage, Groundwater, Groundwater movement, Wells, Water wells, Water levels, Water table, Aquifer characteristics, Hydrogeology, *Denmark, *Egebjerg(Denmark).

The applicability of the Theis-formula and the Jacob-Hantush leakage-formula as tools for the description of water-level variations due to pumping from artesian aquifers was shown to be rather limited, especially in long-term pumping situations. The limitations were discussed and illustrated through a review of some mathematical models with more reliable and physical realistic preconditions, and a general perception of the physics governing the drawdowns in pumping from leaky artesian aquifers was established. Data from 10 years of heavy pumping from a leaky artesian multi-aquifer at Egebjerg near Horsens, Denmark, were analyzed, and the result turned out to be in good agreement with the theoretical discussion. (Sims-ISWS)
W79-06404

2G. Water In Soils

LONGITUDINAL DISPERSION WITH NONLINEAR ADSORPTION IN POROUS MEDIA,
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W79-06027

A WATER MANAGEMENT MODEL FOR SHALLOW WATER TABLE SOILS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 641, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Report No 134, November, 1978. 178 p, 57 fig, 29 tab. OWRT A-086-NC(4). 14-34-0001-7070.

Descriptors: *Water management, *Surface drainage, Subsurface drainage, Subsurface irrigation, *Computer models, Soil moisture, Water table, *Soil water movement.

A study was conducted to develop and test a water management model, DRAINMOD, for shallow water table soils. The objective was to develop a model for soils that normally require artificial drainage, either surface or subsurface, for efficient crop production. The model has the capability of simulating on a day-to-day, hour-by-hour basis the table position, soil water content, drainage ET and surface runoff in terms of climatological data, soil properties, crop parameters, and the water management system design. By simulating the performance of alternative system designs over several years of record, an optimum water management system can be designed. The basis of the model is a soil water balance in the soil profile. It is composed of a number of separate components, incorporated as subroutines to evaluate various mechanisms of water movement and storage in the soil profile. These components include methods to evaluate infiltration, subsurface drainage, surface drainage, potential evapotranspiration (ET), actual ET, subirrigation and soil-water distribution. Approximate methods were used for each component so that the required inputs would be simplified and consistent with available data. The model was constructed so that improved methods can easily be substituted for existing components as they become available. (Kiger-North Carolina)
W79-06050

EVAPOTRANSPIRATION FROM DOUGLAS FIR STANDS EXPOSED TO SOIL WATER DEFICITS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 2D.
W79-06068

THE GENERALIZATION OF DARCY'S LAW FOR NONUNIFORM FLOWS,
Tel Aviv Univ., (Israel). School of Engineering.
For primary bibliographic entry see Field 2F.
W79-06080

DIRECT IN-FIELD MEASUREMENT OF NITROUS OXIDE FLUX FROM SOILS,
California Univ., Riverside. Dept. of Soil and Environmental Science.
J. C. Ryden, L. J. Lund, and D. D. Focht.
Soil Science Society of America Journal, Vol 42, No 5, p 731-737, September-October, 1978. 2 fig, 5 tab, 29 ref.

Descriptors: *Denitrification, *Nitrates, Gas chromatography, Measurement, Fertilization, Ozone, Methodology, Data collections.

A method was developed whereby nitrous oxide N2O effusing from a soil surface could be contained and selectively trapped for subsequent analysis. The methodology proposed provides a direct measurement of N2O flux which is integrated over the sampling period used. The methodology is sufficiently simple that it embodies a monitoring capability which can be used to measure N2O evolution in on-going agricultural practice. The method may also provide a basis for the direct measurement of total N loss as a result of denitrification, if the further reduction of N2O can be inhibited. (Skogerboe-Colorado State)
W79-06147

A RAPID METHOD FOR ESTIMATING THE NITROGEN-SUPPLYING CAPABILITY OF A SOIL,

Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. H. Fox, and W. P. Piekielek.
Soil Science Society of America Journal, Vol 42, No 5, p 751-753, September-October, 1978. 2 fig, 1 tab, 8 ref.

Descriptors: *Nitrogen, Nutrient requirements, Fertilization, Nutrients, Crop response, Corn, Correlation analysis, *Soil tests.

Nitrogen fertilizer recommendations in humid regions have been primarily based on crop N requirements without regard for the variability in the N-supplying capability of the soil. The authors found that two previously proposed N availability indexes, 0.01M NaHCO3 and boiling 0.01M CaCl2 extractable N, were well correlated (r=0.77 and 0.86, respectively; $P < 0.01$ for both) with the capability of eight Pennsylvania soils to supply N to field grown corn, (Zea mays L.). However, the time and expense required for these analyses may preclude routine use by soil testing laboratories. In seeking ways to shorten and simplify the analyses, it was found that the ultraviolet (UV) absorption by the 0.01M NaHCO3 soil extract at 260 nm was as well correlated with the N-supplying capability of the test soils ($r = 0.865$ $P < 0.01$) as the best of the previously evaluated extractable N indexes. This new method is as rapid, simple, and inexpensive as the methods currently used to measure availability of other essential nutrients in the soil. It was also demonstrated how this method can be used to predict more accurately the fertilizer N needs for corn. (See also W79-06160) (Skogerboe-Colorado State)
W79-06159

FIELD TESTING OF SEVERAL NITROGEN AVAILABILITY INDEXES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. H. Fox, and W. P. Piekielek.
Soil Science Society of America Journal, Vol 42, No 5, p 747-750, September-October, 1978. 2 fig, 3 tab, 9 ref.

Descriptors: *Nitrogen, Fertilization, *Soil tests, Crop production, Chemical analysis, Crop response, Corn.

Eight N availability indexes were correlated with the capability of eight Pennsylvania soils to supply N to field-grown corn (Zea mays L.) in 1976 and 1977. Boiling 0.01M CaCl2 and 0.01M NaHCO3-extractable N were both significantly correlated at the 1% level ($r = 0.86$ and 0.77, respectively) with the N-supplying capability of the soils from the combined 1976 and 1977 experiments. Autoclave-extractable NH4-N and total soil N were significantly correlated with the soil supplying capability at the 5% confidence level ($r = 0.70$ and 0.68, respectively). Walkley-Black soil organic matter, soil NO3(-), and H2SO4-extractable and KCl-extractable N were not significantly correlated with N availability in the field. Though four of the indexes were well correlated with the N availability in the soil, time and expense necessary for these analyses may preclude routine use by soil testing laboratories. (Skogerboe-Colorado State)
W79-06160

SOIL WATER IN SOUTHWESTERN MINNESOTA: FOUR STAGES,
Minnesota Univ., St. Paul. Dept. of Soil Science.
D. G. Baker, and W. W. Nelson.
Journal of Soil and Water Conservation, Vol. 34, No. 1, p 28-30, January-February 1979. 2 fig, 2 tab, 8 ref.

Descriptors: *Soil water, *Recharge, *Consumptive use, *Minnesota, On-site investigations, On-site data collections, Data processing, Frozen soils, Crops, Corn, Soybeans, Evapotranspiration, Evaporation, Seasonal, Temperature, Precipitation(Atmospheric), Discharge(Water), Climatology.

A unique series of soil water records from a southwestern Minnesota watershed show how and with what efficiency precipitation is used. These records, now covering 17 years (1960-1976), include years of climatic extremes that range from periods of surplus precipitation to the drought of 1976. The watershed is in the western Corn Belt where soils seldom recharge completely with water. While unusual in most of the Corn Belt, this recharge condition is common over half the United States. In addition to the soil water records, associated data were available that permit investigation of the area's climatology and hydrology. (Sims-ISWS)
W79-06236

BOUNDARY SOLUTIONS TO TWO PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W79-06254

ESTIMATION OF THE PORE SIZE DISTRIBUTION FROM THE MOISTURE CHARACTERISTIC,
Ghent Rijksuniversiteit (Belgium). Dept. of Applied Mathematics.
E. H. D'Hollander.
Water Resources Research, Vol 15, No 1, p 107-112, February 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Pores, *Soil moisture, *Moisture content, *Statistical models, Probability, Mathematical models, Distribution patterns, Curves, Air-water interfaces, Equations, Capillary action, Saturation, Retention, Theoretical analysis, Pore radius, Suction.

Most pF curves are shaped as cumulative distribution functions. From this observation, restricted to nonshrinking or swelling soils, a close relationship was established between the moisture characteristic and the pore size referred to as the effective pore radius. For many soils showing a moisture characteristic similar to a normal cumulative distribution function, the derived pore size distribution is log normal. In this case, a direct identification technique was developed which yields the parameters of the density function from the experimental pF theta relationship. Practical applications demonstrated the validity of this probabilistic model, which gives good agreement with morphometric pore size data available in the literature. The model also gives rise to an analytical expression for the pF curve in terms of two structural parameters of the porous system, the mean and the standard deviation of the effective pore radius. (Visocky-ISWS)
W79-06258

MODELS OF GROUNDWATER FLOW IN STATISTICALLY HOMOGENEOUS POROUS FORMATIONS,
Tel Aviv Univ. (Israel). School of Engineering.
For primary bibliographic entry see Field 2F.
W79-06262

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMENTAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
For primary bibliographic entry see Field 5B.
W79-06401

ESTIMATION OF THE ERROR IN THE DETERMINATION OF SOIL WATER STORAGE AT OBSERVATION POINTS,
N. Ye. Leonova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 98-101, 1977. 3 fig, 3 tab, 3 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 118-126, 1977.

Descriptors: *Soil water, *Water storage, *Flood forecasting, Floods, Runoff, Snowmelt, Melt water, Soils, Soil types, Crops, Agriculture, Rivers, Drainage, Storage, *USSR, Error estimation.

In forecasting and computing springtime flood runoff, the question arises as to the accuracy of determination of the major flood-forming factors, which are the water equivalent of snow and the wetting and freezing of the soil. The computed estimates of errors in the determination of the average water storage in soil using long-period observations of soil moisture in the Don River basin upstream of Kazanskaya village and of observations over 5 years by the expedition of the State Hydrological Institute in small drainage areas of this basin lead to the following conclusions: (1) Errors in the initial data on the water storage in soil, determined in the areas of agrometeorological stations under homogeneous crops, are close to the permissible limit (delta = 0.5) or exceed it, amounting to 8-18% (0- to 30-cm layer), 7-12% (0- to 50-cm layer), and 6-9% of the average (0- to 100-cm layer). (2) Errors in the initial data on water storage, averaged over several areas of agrometeorological stations, on average water storage determined on 3-km courses in small drainage areas of 2000-5000 sq km, and on water storage measured at individual points on these courses are within permissible limits. (3) Annual average water storage in soil under winter crops is determined least accurately in June in the upper soil horizons. This is associated with an increase in the variations in soil moisture as a result of uneven soil drying. (Sims-ISWS)
W79-06410

ROLE OF HYDROPHYSICAL SOIL PROPERTIES IN SPRING FLOOD RUNOFF LOSSES,
I. L. Kalyuzhnny, K. K. Pavlova, and N. V. Sokolova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 102-107, 1977. 3 fig, 2 tab, 10 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 127-136, 1977.

Descriptors: *Soil properties, *Soil water, *Water storage, *Floods, Flood forecasting, Soils, Soil types, Infiltration, Permeability, Porosity, Storage, Forest soils, Agriculture, Frozen soils, Runoff, Drainage, Melt water, Snowmelt, *USSR.

The volume and dynamics of meltwater losses by infiltration are determined by the infiltration capacity of soils in a drainage basin. Under certain soil temperature to soil moisture ratios, the infiltrating water can clog all the water-conducting pores and the soil becomes impermeable, forming a so-called barrier layer. The problem of the conditions under which the ice forming during the crystallization of infiltrating water is capable of clogging all the water-conducting pores has been solved thermo-physically and made practically usable. Forest soils are highly permeable and a barrier layer forms extremely rarely in them. Field soils are less permeable and a barrier layer forms fairly frequently in their upper layers during warm spells in winter and during the snow melting period in spring. The losses and coefficient of spring flood runoff in wooded basins are determined mainly by the soil moisture deficit in the pre-spring period and are virtually independent of soil freezing depth. The main factors determining the magnitude and dynamics of meltwater losses by infiltration in the field are the depth of freezing and degree of wetting of the soil and also its thermal properties. The water storage in the upper meter of soils in the field and forest during the pre-spring period are similar, but the soil moisture deficit is greater in the forest. Soil water storage varies in the course of the winter, and its greatest increase is observed in winters with warm spells. (Sims-ISWS)
W79-06411

2H. Lakes

TIME AND LENGTH SCALES FOR THE ONE-DIMENSIONAL ASSUMPTION AND ITS RELATION TO ECOLOGICAL MODELS,
Army Engineer Waterways Experiment Station, Vicksburg. Environmental Effects Lab.
D. E. Ford, and K. W. Thornton.
Water Resources Research, Vol. 15, No. 1, p 113-120, February 1979. 4 fig, 68 ref.

Descriptors: *Model studies, *Temporal distributions, *Spatial distributions, Ecology, Lakes, Reservoirs, Oceans, Waves(Water), Temperature, Water temperature, Biology, Chemistry, Hydrodynamics, Mathematical models, Statistical models.

The vertical one-dimensional assumption was examined with respect to its validity for mathematical ecological models of lakes or reservoirs. Analysis of the time and length scales characterizing the hydrodynamics, chemistry, and biology showed that the 2 scales are inexorably coupled, and their interaction dictated both upper and lower bounds for the lake size that can be characterized by a one-dimensional model. For an update frequency or forcing time scale of 1 day, the one-dimensional model was restricted to lakes characterized by length scales of 0.5-10 km. This range is preliminary and dependent on model formulation and update frequency. Inconsistencies between the model formulation scales for the hydrodynamics, chemistry, and biology may result in erroneous model predictions. (Sims-ISWS)
W79-06073

SALINITY TRANSPORT BETWEEN LAYERS OF A STRATIFIED SHEAR FLOW,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
J. Freitas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 652, Price codes: A04 in paper copy, A01 in microfiche. MS thesis, February 1979, 68 p, 7 tab, 2 append., 6 fig. OWRT B-139-UTAH(3), 14-34-0001-7191.

Descriptors: *Saline lakes, Saline water systems, *Stratified flow, Hydrodynamics, Parametric hydrology, Entrainment, Great Salt Lake, Pycnocline, Richardson number.

In order to effectively manage the Great Salt Lake and its tributaries, an advanced knowledge of the hydrodynamic processes occurring within this body of water must be available. A research project was undertaken to determine parameter relationships and the extent of entrainment occurring at the pycnocline within the southern arm of the Great Salt Lake. Dealing with the two-layer stratified system existing within the southern arm--an upper dilute brine layer over a lower dense brine layer--an attempt was made to model interfacial conditions of the southern arm within a laboratory flume. Using characteristic hydrodynamic, kinematic, and geometric parameters of the lake the southern arm of the lake was artificially created in the flume. Through the use of this experimental apparatus a determination was made of the relationships between dimensionless numbers representing upward mixing, relative density difference and the Richardson number. In addition, predictions of the magnitude of the entrainment rate per unit area, k, were established. Visual observations of the interface condition at various velocity steps were also made. Comparison of these results to those made by other entrainment researchers, allowed substantiation of this research. When compared to other salt lake research the flume model consistently predicted larger values of entrainment. It is felt that this research more accurately represented the conditions at the interface of the southern arm, while other researchers made necessary assumptions to expedite the theoretical development of the processes at the interface.
W79-06106

MODELING AND VERIFICATION: THE TWO INDISPENSABLE LEGS FOR PROGRESS TOWARD UNDERSTANDING AND MANAGEMENT OF AQUATIC SYSTEMS AS DEMONSTRATED BY A STUDY OF COASTAL CURRENTS IN LARGE LAKES,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
C. H. Mortimer.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 316-338 (Discussion p 339), September 1978. 17 fig, 13 ref. EPA-600/9-78-024.

Descriptors: *Lakes, *Lake Michigan, *Model studies, *Coastal waters, *Currents(Water), *Thermocline dynamics, Computer models, Optimal development plans, Aquatic systems, Remote sensing, Wind velocity, Temperature, Lake Ontario, Basins, Channels, Waves(Water), Risks, Stratification, Physics, Prediction, Kelvin waves, Water intake, Milwaukee(Wis), Meter stations, Offshore depth, Wind direction, Systems analysis, Simulation analysis.

There are two risks associated with computerized mathematical modeling of aquatic systems: (1) limited research funds will not be spent in an optimum interactive balance between model development and field experimentation; and (2) when eventually it becomes apparent that the desired predictive capability has not lived up to expectation, adverse reaction will starve the development of better models. Addressed herein is the avoidance of the first risk, which if successfully accomplished, will diminish the second risk. Our best hope of progress lies in a proper balance between questions directed both to models and to lakes, often in an iterative two-legged sequence in which models assist the planning of optimized schemes of data acquisition. Soundly-conceived and adequately-based 'hard' sets of data, from experiments and lake surveys, are the only means through which models can be used to their full potential. Models are discussed as scientific tools to define the most revealing questions we can ask about lakes. Considered are the physics of large lakes, namely the responses of the stratified basin to wind impulses. Studied are models of thermocline dynamics; with these models, signals from large-basin coastal currents can be heard. The article concludes with some general remarks on lake ecosystem modeling. (See also W79-06166) (Bell Graf-Cornell)
W79-06179

CONSTRUCTION OF A MODEL OF LAKE BAIKAL ON PRINCIPLES OF SELF-ORGANIZATION,
Akademiya Nauk URSR, Kiev. Inst. Kibernetiki.
A. G. Ibakhnenko.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 340-369 (Discussion p 370-371), September 1978. 10 fig, 4 tab, 40 ref. EPA-600/9-78-024.

Descriptors: Self-organization, *Model construction, *Lake Baikal(USSR), *Model studies, Algorithms, Equations, Water pollution, Dissolved solids, Suspended solids, Forecasting, Biomass yield, Phytoplankton, Zooplankton, Mixing zones, Systems analysis.

Lake Baikal contains 80% of the freshwater reserve in the USSR and 20% of the world source. Irkutsk University and the Institute of Cybernetics of Ukr. SSR Academy of Sciences have carried out joint research aimed at a better understanding of correlation links between phytoplankton and zooplankton in Lake Baikal. The results of this research are given in Appendix I. The main part of this report reflects the results of a joint investigation carried out by the Novocherkassk Hydrochemical Institute and the Institute of Cybernatics of Ukr. SSR Academy of Science (1973-1975). It is concerned with the construction of three mathematical models of Lake Baikal mixing zones on the basis of self-organization principles. (See also W79-06166) (Bell Graf-COrnell)
W79-06180

THE BOTTOMLESS DAM,
Monash Univ., Clayton (Australia).
For primary bibliographic entry see Field 8A.
W79-06263

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

CONCEPTUAL FRAMEWORK FOR COORDINATED GREAT LAKES MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
S. V. Rastonis, J. W. Male, and H. E. Allen.
Journal of Great Lakes Research, Vol 4, No 2, p 117-126, June 1978. 2 tab, 30 ref.

Descriptors: *Great Lakes, *Monitoring, *Mathematical models, Sampling, Surveys, Remote sensing, Planning, Pollutants, Water pollution, Sediments, Biology, Fish, Aquatic plants, Chemicals, Methodology, Lakes, Limnology, Model studies.

The utility of conceptual models was discussed as a basis for effective development of coordinated monitoring efforts on the Great Lakes. The use of conceptual models was illustrated in two ways, (1) the development of a methodology for specifying monitoring objectives of the Great Lakes, based on a conceptual model, and (2) the presentation of a comprehensive method for defining resource needs to achieve monitoring objectives. (Sims-ISWS)
W79-06402

LAKE ERIE IN MID-WINTER,
Canada Centre for Inland Waters, Burlington (Ontario).
N. M. Burns, F. Rosa, and A. Gedeon.
Journal of the Great Lakes Research, Vol 4, No 2, p 134-141, June 1978. 5 fig, 4 tab, 10 ref.

Descriptors: *Lake Erie, *Great Lakes, *Sampling, *Winter, Surveys, Lakes, Temperature, Water temperature, Nutrients, Oxygen, Dissolved oxygen, Phytoplankton, Biomass, Diatoms, Nitrogen compounds, Silica, Phosphorus, Ice, Ice cover, Lake ice, On-site investigations, Limnology.

The results of 4 surveys of Lake Erie during mid-winter were presented. The most recent survey, from February 15 to 17, 1977, was conducted during an exceptionally cold winter to determine whether 6 weeks of complete ice-cover had led to low levels of oxygen concentration in the lake. The results showed that all parts of the lake, even the shallow, normally highly productive areas, contained acceptable levels of oxygen. Apparently, production of oxygen by a small phytoplankton population counter-balanced a fairly low uptake of oxygen and maintained the level of oxygen concentration in most of the water above 90% saturation. The 1976-1977 winter phytoplankton biomass was low (0.1 to 1.0 gm biomass per cu m) and consisted mostly of diatoms. It appears that some of the phytoplankton were photosynthetically active under 70 cm of ice and 23 m of water. All surveys of the lake showed the water to be virtually isothermal at a temperature just above the freezing point of water. The maximum temperature differences observed were about 0.2 deg in magnitude and were found in the East Basin. Nevertheless, the slight temperature differences apparently caused density currents under the ice, which resulted in lowered oxygen concentrations in the deepest part of the East Basin. (Sims-ISWS)
W79-06403

2I. Water In Plants

IF YOU KNOW THE WEATHER YOU CAN PREDICT THE YIELD,
Clemson Univ., SC. Dept. of Horticulture.
J. R. Haun.
Crops and Soils Magazine, Vol. 31, No. 2, p 7-9, November, 1978. 3 fig.

Descriptors: Crop production, Crop response, Climatic data, Weather data, Plant growth.

This paper presents a new concept in the evaluation of plant-environment relations for developing yield prediction systems. This approach involves the daily measurement of plant response in the field under natural, uncontrolled variations in weather conditions. These plant growth data, with associated weather variables, are to be analyzed by computer to develop the yield prediction system. (Skogerboe-Colorado State)
W79-06035

SALT AND WATER STRESS INFLUENCES NITROGEN METABOLISM IN RED KIDNEY BEANS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
J. N. E. Frota, and T. C. Tucker.
Soil Science Society of American Journal, Vol. 42, No. 5, p 743-746, September-October, 1978. 6 tab, 27 ref.

Descriptors: *Salinity, *Moisture deficit, Nitrogen, Metabolism, Beans, Crop production.

Both salinity and water deficit reduce yields of crop plants. This study was an attempt to provide a better understanding of these stress effects on N metabolism and the utilization of NH4-N and NO3-N. Red kidney bean plants (Phaseolus vulgaris L.) were grown under salt stress (NaCl), water stress (carbowax), and in a normal nutrient solution (control). The 15N in NO3(-), NH4(+), alpha amino acids, total soluble-N and protein-N in plant shoots were analyzed after the plants received 15(NH4)2SO4 and K15NO3 in nutrient solution for 6, 12, 24, and 48 hours. Sodium chloride and carbowax resulted in equal accumulations of NO3-N, NH4(+), and free alpha amino acids in bean shoots. Protein synthesis was significantly reduced in bean shoots when the plants were subjected to NaCl salinity and carbowax, with either source of N, and the inhibition was more severe under salt stress than water stress. (Skogerboe-Colorado State)
W79-06156

ABSORPTION RATES OF AMMONIUM AND NITRATE BY RED KIDNEY BEANS UNDER SALT AND WATER STRESS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
J. N. E. Frota, and T. C. Tucker.
Soil Science Society of America Journal, Vol. 42, No. 5, p 753-756, September-October, 1978. 2 fig, 5 tab, 21 ref.

Descriptors: *Salinity, *Moisture stress, Absorption, Ammonium salts, Nitrates, Beans, Moisture deficit, Crop production, *Crop response, Nitrogen.

The purpose was to gain additional knowledge regarding the influence of salinity and water deficit on plant uptake of NH4(+) and NO3(-). The absorption patterns of NH4(+) and NO3(-) by red kidney beans (Phaseolus vulgaris L.) were determined under normal conditions (water stress) using an inverse isotope dilution technique with 15N. Salt and water stress inhibited the absorption of both NH4(+) and NO3(-). There was no difference between these two stress treatments in NH4(+) uptake, but carbowax restricted NO3(-) uptake more than did NaCl. Under NaCl salinity the plants absorbed the same amount of N independent of N source; under water stress more NH4(+) than NO3(-) was absorbed. Water absorption was reduced by both stress treatments; N and water uptake were highly correlated. Root permeability decreased in plants subjected to stress. Dry matter production and total N per plant decreased, but the N percentage increased in the stressed plants. (Skogerboe-Colorado State)
W79-06157

2J. Erosion and Sedimentation

BASIC HYDROGEOLOGY - GLACIAL DEPOSITS AS AQUIFERS,
B. Whitehead.
Canadian Water Well, Vol. 5, No. 1, p 34-35, February, 1979. 1 fig.

Descriptors: *Glacial aquifers, *Well yield, Glacial drift, Deposition(Sediments), Hydrogeology, Till, Outwash, Lake sediments.

The classification of glacial deposits is explained in terms of their mode and environment of deposition. Four basic types of glacial deposits are described: till, outwash, lacustrine and marine, and ice-contacted. A typical glacial stratigraphic sequence and the resulting variety of aquifer types are shown in a generalized cross section. The well yields in the various aquifers increases with the thickness, degree of sorting, and grain size of the deposit and the degree of interconnection of the aquifer to recharge sources. (Purdin-NWWA)
W79-06013

FACTORS AFFECTING PHOSPHATE ABSORPTION EQUILIBRIA IN LAKE SEDIMENTS,
Dufresne-Henry Engineering Corp., North Springfield, VT.
For primary bibliographic entry see Field 5C.
W79-06032

DERIVATION OF THE PROBABILITY DENSITY FUNCTION OF CERTAIN BIASED SAMPLES OF COARSE RIVERBED MATERIAL,
Pennsylvania State Univ., University Park. Dept. of Geosciences.
K. W. Potter.
Water Resources Research, Vol. 15, No. 1, p 21-22, February 1979. 1 tab, 5 ref.

Descriptors: *Beds, *Bed load, *Sampling, *Data processing, Analytical techniques, Mathematics, Particle size, Streambeds, Statistics, Probability, Equations, Sediments, Rivers, Riverbed material, Weighting functions.

Several commonly used procedures for sampling coarse riverbed material result in samples that are biased toward the larger particles. Kellerhals and Bray recommend correcting the bias by scaling the sample frequency of each frequency interval by the inverse of the appropriate power of the mean grain size of the interval. If, however, grain size is assumed to be log-normally distributed, it is possible to determine the distribution of the biased sample. This provides explicit bias factors for the sample moments. (Sims-ISWS)
W79-06077

OIL SPILL VULNERABILITY OF THE BEAUFORT SEA COAST,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06210

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06219

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5C.
W79-06227

COASTAL PROCESSES AND MORPHOLOG OF THE BERING SEA COAST OF ALASKA
Geological Survey, Menlo Park, CA.
A. J. Sallenger, Jr., J. R. Dingler, and R. Hunter.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII Hazards, p 451-502, October 1978. 7 fig, 4 tab, 1 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Geomorphology, *Erosion, *Hazards, *Water pollution, *Structural engineering, Baseline studies, Resources development, Pipelines, Environmental effects, Alaska, *Outer Continental Shelf, *Coastal processes, Bering Sea, Petroleum development.

Storms pose major hazards to coastal developments along the Bering Sea coast of Alaska. During FY76, debris lines that resulted from the November, 1974 storm were found to be nearly 5 m above mean sea level in places along the northern Bering Sea of Alaska. Coastal change is not, however, restricted to storm conditions. Giant cusps were observed to migrate along the coast at 5-6 m/day during the period 6/23/51 - 7/30/51. This migration caused as much as 50 m accretion at a given location over a period of several weeks. One use of this kind of data is to establish a coastal development set-back line. That is, the appropriate government body would prohibit developments within areas subject to inundation by storm surge or undermining by coastal erosion. For structures that must cross the coastline (e.g. pipelines) the maximum scour depth must be established for both storms and over the long-term. The south coast of the Alaska Peninsula has numerous deep embayments which may one day be considered for deep water port facilities. These ports could service offshore petroleum exploitation in both the Bristol Bay area and areas offshore the Pacific coast of the Alaska Peninsula. In order to provide some baseline information, a reconnaissance of the physical coastal environment of Cold Bay and Pavlov Bay was undertaken. The results can be used for preliminary siting studies, qualitative assessment of coastal stability and the long-term directions of transport of particulate pollutants in the littoral system. (Sinha-OEIS)
W79-06228

SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
D. M. Hopkins, and R. W. Hartz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 503-573, October 1978. 12 ref, 5 append, map infold. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Geomorphology, *Gravels, *Quarries, *Erosion, Permafrost, Water pollution, Coasts, Baseline studies, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum development, Chukchi Sea, Beaufort Sea, Coastal processes.

This report presents detailed data on stratigraphy, lithology, pollen rain, longshore sediment transport, coastal erosion, coastal morphology, and shoreline history. Exploration and production of offshore oil and gas reserves in the Beaufort Sea will require large amount of artificial fill for the construction of causeways, pipelines, artificial islands, and support facilities. Gravel is the primary material used for artificial fill in the arctic, and the location of potential quarry sites is essential to the development and production phases. The environmental impact of quarrying operations can be minimized by locating areas of thick gravel deposits or sites where gravel is now accumulating. Construction of onshore support facilities also requires

knowledge of potential flooding hazards during storm surges and the possible effects of coastal erosion. (Sinha-OEIS)
W79-06229

THE HYDRODYNAMICS AND SEDIMENTOLOGY OF A HIGH (TIDAL AND WAVE) ENERGY EMBAYMENT (SWANSEA BAY, NORTHERN BRISTOL CHANNEL),
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
M. Collins, G. Ferentinos, and F. T. Banner.
Estuarine and Coastal Marine Science, Vol. 8, No. 1, p 49-74, January 1979. 14 fig, 1 tab, 47 ref.

Descriptors: *Sediments, *Currents(Water), *Bays, Tidal effects, Tides, Waves(Water), Circulation, Water circulation, On-site data collections, Current meters, Bathymetry, Sampling, Waves(Water), Sedimentation, Hydrodynamics, *Wales, *Swansea Bay(Wales).

Swansea Bay may be taken as an example of an embayment which has a complex and variable hydrodynamic regime resulting from the interaction of its bathymetry and configuration with an adjacent rectilinear, semi-diurnal tidal system and with super-imposed oceanic swell and more locally generated seas. Eulerian tidal current observations in Swansea Bay indicated a coastal tidal current pattern which has developed from the main currents along the northern Bristol Channel. The observed pattern consists of an anticlockwise eddy in the western part of the embayment and a zone of divergence on the eastern side, between the eddy and the main offshore flow. Wave data, as represented by refraction diagrams and the distribution of sea bed orbital velocities, have demonstrated that high energy wave conditions prevail over the area. Sediment distribution and transport in Swansea Bay are controlled by tidally and wave-induced current patterns, but also are related to bathymetry and the exposure of relict deposits. However, evidence was presented to suggest that local dredging activities influence the sedimention processes. (Sims-ISWS)
W79-06237

THE DISTRIBUTION OF ORGANIC MATERIAL AND TRACE METALS IN SEDIMENTS FROM THE RIVER LIFFEY ESTUARY, DUBLIN,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 2L.
W79-06239

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

ROSS SEA REGION IN THE MIDDLE MIOCENE: A GLIMPSE INTO THE PAST,
Macquaries Univ., North Ryde (Australia). School of Biological Sciences.
H. Brady, and H. Martin.
Science, Vol 203, No 4379, p 437-438, February 2, 1979. 1 fig, 1 tab, 5 ref. NSF DP76-20657, DP76-17231.

Descriptors: *Sediments, *Cores, *Diatoms, *Pollen, *Antarctic, Palynology, Spores, Ice, Cold regions, Vegetation, Biology, Ferns, Geology, Marine geology, *Ross Ice Shelf, Miocene sediments.

Fossil diatoms and pollen from sea-floor sediments beneath the Ross Ice Shelf indicated that a permanent ice cover was not present in the Ross Sea and that vegetation including angiosperms, gymnosperms, and ferns existed on at least some parts of the largely glaciated Antarctic mainland in the late middle Miocene. (Sims-ISWS)
W79-06244

MIOCENE GLACIOMARINE SEDIMENTS FROM BENEATH THE SOUTHERN ROSS ICE SHELF, ANTARCTICA,
Northern Illinois Univ., De Kalb. Dept. of Geology.
P. N. Webb, T. E. Ronan, Jr., J. H. Lipps, and T. E. DeLaca.
Science, Vol. 203, No.4379, p 435-437, February 2, 1979. 2 fig, 13 ref. NSF DP76-20657, DP76-17231.

Descriptors: *Sediments, *Cores, *Microorganisms, *Antarctic, Ice, Drill holes, Drilling, Clays, Sands, Gravels, Sedimentary structures, Marine geology, Geology, Diatoms, Plankton, Sedimentation, Cold regions, *Ross Ice Shelf, Glaciomarine sediments, Miocene sediments.

Glaciomarine sediments with middle Miocene microfaunal assemblages are exposed at the sea floor below the southern Ross Ice Shelf. Plio-Pleistocene sediments are not present. Post-Miocene glacial sediments may have been deposited but removed by relatively recent ice shelf grounding. A meager Recent microfauna is present in some core tops. (Sims-ISWS)
W79-06246

MODELING ALLUVIAL CHANNEL BED TRANSIENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, J. L. Garcia, and D. B. Simons.
Journal of the Hydraulic Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14456, p 245-256, March 1979. 6 fig, 10 ref, 2 append.

Descriptors: *Bed load, *Model studies, *Alluvial channels, Beds, Erosion, Aggradation, Fluvial sediments, Numerical analysis, Rivers, Sedimentation, Mathematical models, Sand waves, *Bed load movement, Fluvial hydraulics.

A mathematical model was developed to simulate bed transient formation and propagation in alluvial channels. The mode is of the known-discharge type, i.e., within one time step, the water discharge is considered steady. This technique allows for the implicit numerical modeling of bed transient propagation using longer time steps than would otherwise be possible using the conventional sequential routing method. Instability due to ill-posing of the sediment transport function is circumvented by using a power relation between bed material transport and mean flow velocity. Errors in mass conservation due to linearization at the boundary are eliminated by using a nonlinear formulation of the upstream boundary condition. (Lee-ISWS)
W79-06252

PARTICLE SIZE OF SEDIMENTS COLLECTED FROM THE BED OF THE AMAZON RIVER AND ITS TRIBUTARIES IN MAY AND JUNE 1977,
Geological Survey, Denver, CO. Water Resources Div.
C. F. Nordin, Jr., R. H. Meade, W. F. Curtis, N. J. Bosio, and B. M. Delaney.
Geological Survey open-file report 79-329, 1979. 23 p, 1 fig, 3 tab, 3 ref.

Descriptors: *Bottom sediments, *Rivers, *South America, *Sampling, *Particle size, Analytical techniques, Fluvial sediments, *Bed material, *Amazon River.

One-hundred-eight samples of bed material were collected from the Amazon River and its major tributaries between Belem, Brazil, and Iquitos, Peru. Samples were taken with a standard BM-54 sampler or with pipe dredges from May 18 to June 5, 1977. Most of the samples have median diameters in the size range of fine to medium sand and contain small percentages of fine gravel. Complete size distributions are tabulated. (Woodard-USGS)
W79-06309

TRENDS IN SEDIMENTATION,
Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
H. R. Feltz, and W. J. Herb.
In: The Freshwater Potomac: Proceedings of a Symposium in January 1977, College Park, Maryland. Published by the Interstate Commission on the Potomac River Basin, Rockville, Maryland, p 167-171, 1978. 3 fig, 13 ref.

Descriptors: *Sedimentation, *Potomac River, *Sediment transport, *Water quality, *Sediment yield, Bottom sediments, Sampling, Chemical analysis, Trace elements, Heavy metals, Nitrogen, Phosphorus, Pesticides, Polychlorinated biphenyls, Streamflow, Runoff, Storms, Hurricanes, Land use, Sediment control, *District of Columbia, *Maryland, *Potomac River basin, *Anacostia River.

The Potomac River, draining an area of 29,700 square kilometers above tidal influence, is known to have wide fluctuations in water and sediment discharge in rapid response to rainfall. Most of the suspended-sediment load is transported during storms, and loads vary from storm to storm and seasonally. Hurricanes such as Agnes in 1972 can also produce high runoff and sediment discharge. Cropland, construction sites, and stream channels undergoing realinement are major sources of suspended sediment. Available figures indicate that changes in land use over the whole basin were insignificant during 1961-76. About 95 percent of the basin consists of rural, forested, and open-water areas. On the basis of annual values of sediment discharge per unit volume of water discharge, the overall trend in the basin was a decrease in suspended-sediment discharges during the mid- to late 1960's followed by an increase in the early 1970's. The high suspended-sediment discharges associated with Hurricane Agnes in 1972 are partly responsible for this increase. In the mid-1970's the trend reversed, and decreases have reached the levels of the early and mid-1960's. A dramatic decrease in suspended-sediment discharge for the Anacostia River near Colesville, Md., is attributed primarily to an increased use of sediment controls on urban construction sites. Chemical analysis of bottom sediment samples collected throughout the basin show the distribution of heavy metals, nitrogen, phosphorus, and residues of pesticides and polychlorinated biphenyls. Trace quantities to relatively high concentrations were found at several sites. (Woodard-USGS)
W79-06319

UNIT STREAM POWER EQUATIONS FOR TOTAL LOAD,
Corps of Engineers, Chicago, IL. North Central Div.
C. T. Yang.
Journal of Hydrology, Vol. 40, No. 1/2, p 123-138, January 1979. 4 fig, 4 tab, 20 ref.

Descriptors: *Sediment load, *Bed load, *Methodology, *Data collections, *Dunes, *Streamflow, Regression analysis, Dimensional analysis, Sediment transport, Natural streams, *Unit stream power, *Sediment concentration, Incipient motion, Potential energy expenditure.

A dimensionless unit stream power equation for the computation and prediction of total sediment concentration was obtained without using any criterion for incipient motion. This equation was compared with a similar dimensionless unit stream power equation with the inclusion of criteria for incipient motion. Comparisons between the measured results from laboratory flumes and natural rivers and the computed results from these two unit stream power equations indicated that they are equally accurate in predicting the total sediment concentration in the sand size range. For the 1259 sets of data compared, the average computed result from these equations was only 3% higher than the measured result. (Singh-ISWS)
W79-06392

UNIT STEP AND FREQUENCY RESPONSE FUNCTIONS APPLIED TO THE WATERSHED FLUVIAL SYSTEM,

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (Israel). Dept. of Agricultural Engineering.
T. C. Sharma, and W. T. Dickinson.
Journal of Hydrology, Vol 40, No 3/4, p 323-335, February 1979. 3 fig, 3 tab, 8 ref.

Descriptors: *Sediments, *Sediment yield, *Model studies, Mathematical models, Equations, Watersheds(Basins), Runoff, Erosion, Sediment transport, Streams, Rivers, Sedimentation, Sedimentology.

Unit step response and frequency response functions were shown to provide useful information to model and understand the watershed runoff-sediment yield process. One of the applications of the unit step response was to rank watersheds for their sediment production potentials. The frequency response function was used to indicate the memory content of the watershed runoff-sediment yield system. (Sims-ISWS)
W79-06395

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDIMENTS OF LAKES SUPERIOR AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W79-06399

DISTRIBUTION OF SUSPENDED SEDIMENTS IN THE SHALLOWS OF RESERVOIRS AND POSSIBILITY OF ESTIMATING THEM BY THE INTEGRATION METHOD,
V. M. Klaven.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 113-119, 1977. 4 fig, 3 tab, 10 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 242, p 115-128, 1977.

Descriptors: *Sediments, *Suspended solids, *Reservoirs, *Shallow water, Sampling, Data processing, Waves(Water), Currents(Water), Sediment transport, Analytical techniques, Distribution patterns, Suspended particle concentrations.

The distribution of suspended-particle concentration in the shallows of bodies of water must be taken into account to solve engineering problems (planning water intakes, ships' channels, harbors, thermal electric power stations) and to improve methods for measuring and computing suspended-particle concentration. The following conclusions can be drawn from the analysis of measurements of suspended sediment transport in the shallows of the Kayrak-Kum, Kakhovka, and Kremenchug reservoirs, made in a broad range of variation of wave heights, velocities of longshore currents, rock composition of the shallows, and suspended-particle concentrations in the water: (1) The time-averaged suspended-particle concentrations on verticals in the surf zone increase approximately exponentially from the water surface to the bottom, and the nature of their distribution does not vary noticeably with a change in the rock composition of the shallows from fine- to medium-grained sand with admixtures of various amounts of silt particles. (2) The distribution of the suspended-particle concentration in the water (rho) and of elementary suspended-sediment transport (r) over the width of the surf zone is most frequently of two types: a distribution with a single maximum in the water-edge zone with rho and r values decreasing gradually toward the edge of the shallows; and a distribution with two maxima, one in the water-edge zone and the other in the zone of the outer-line of breakers, usually confined to the central part or the edge of the shallows. (Sims-ISWS)
W79-06412

INDUCED CHANNEL INSTABILITY AND HYDRAULIC GEOMETRY OF THE MANGAWHARA STREAM, NEW ZEALAND,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2E.
W79-06416

SEDIMENT YIELDS FROM SMALL FORESTED CATCHMENTS NORTH WESTLAND-NELSON, NEW ZEALAND,
Forest Research Inst., Christchurch (New Zealand). Protection Forestry Div.
C. L. O'Loughlin, L. K. Rowe, and A. J. Pearce.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 1-15, 1978. 8 fig, 5 tab, 21 ref.

Descriptors: *Sediment yield, *Sediment transport, *Forest watersheds, *Sediments, Gravels, Sands, Forests, Drainage, Storms, Runoff, Storm runoff, Discharge(Water), Flow, Hydrographs, Sedimentation, Erosion, Sedimentology, *New Zealand.

Sediment yield rates from 6 small forest catchments in North Westland and from 4 small forest catchments in Nelson averaged 55 cu m/sq km p.a. and 5 cu m/sq km p.a., respectively. A total of 55% of sediment yield was produced from the North Westland catchments over 821 days during one large storm event with a return period of approximately 20 years. In the Nelson catchments, 90% of the sediment yield over 608 days occurred during a single storm event with a return period of 6 months to one year. It was hypothesized that the development of the forested gravel hill country landscapes in North Westland and Nelson have depended closely on infrequent high intensity storms which occur perhaps once every 10 years or less frequently. (Sims-ISWS)
W79-06418

STATISTICAL ANALYSIS OF SEDIMENT MOTIONS OF DUNES,
Stone and Webster Engineering Corp., Boston, MA.
C. S. Hung, and H. W. Shen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY3, Proceedings Paper 14438, p 213-227, March 1979. 18 fig, 5 tab, 13 ref, 1 append.

Descriptors: *Bed load, *Colorado, *Channels, *Dunes, Rivers, Sedimentation, Cesium, Sedimentation rates, Statistical methods, Hydraulics, Sediment transport, Alluvial channels, *Statistical analysis, Alluvial bed forms, Cesium 137.

Statistical analyses were done on the movements of bed load particles over alluvial bed forms from data collected in a large laboratory flume at Colorado State University. The bed load particles were tagged by radioactive tracer--Cesium 137. Statistical properties of the random variables and the correlations between these variables were investigated. It was found that within the test range, the mean and variance of longitudinal step length, the mean wavelength and the mean wave height of bed forms, the particle speed, the variance of vertical step length, and the variance of lateral step length all increase with the increase of flow. However, the coefficients of variation for both wave height and wavelength remain approximately the same for all flow conditions tested. The ratio of average wave length to average wave height decreases with the increase of flow. (Lee-ISWS)
W79-06421

SEA-FLOOR INSTABILITY OF CONTINENTAL SHELF OFFSHORE CENTRAL AND NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
A. Mahmood, and R. Son.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resource Development', Proceedings of Conference/Workshop held in San Francisco, CA, October 22-24, 1976, p 99-105, January 1977. 4 fig, 1 ref.

Descriptors: *Stability, *Continental shelf, *Geology, Water quality, Sedimentation, Resources development, Hazards, *Outer Continental Shelf, Sea floor, Northern California, Central California.

The continental shelf along central and northern California coast is very narrow as compared to other coastal areas of United States. The narrow shelf width may force offshore exploration in some steep areas. The potential for sea-floor instability needs to be evaluated as it would influence offshore resource development facilities. From available data a sketchy assessment of slope instability potential can be made. A figure shows areas of moderate and steep slopes along the central and northern California coast. The areas are within the 600 feet water depth. In addition to slope steepness and nature of sediments, data on evidence of past or present instability can be gathered by identifying slumps, scarps, and other landslide topography features on high-resolution data. (See also W79-06464) (Sinha-OEIS)
W79-06465

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
For primary bibliographic entry see Field 5C.
W79-06467

2K. Chemical Processes

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W79-06062

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2F.
W79-06064

PHOSPHORUS INTERACTIONS IN THE AQUATIC ENVIRONMENT: A SURVEY OF THE LITERATURE,
Vermont Univ., Burlington. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W79-06109

EFFICIENT AMENDMENT USE IN SODIC SOIL RECLAMATION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 5G.
W79-06150

CATION-EXCHANGE CAPACITY OF CLAY-RICH SOILS IN RELATION TO ORGANIC MATTER, MINERAL COMPOSITION, AND SURFACE AREA,
Department of Agriculture, Sainte-Foy (Quebec).
Y. A. Martel, C. R. De Kimpe, and M. R. Laverdiere.
Soil Science Society of America Journal, Vol. 42, No. 5, p 764-767, September-October, 1978. 1 fig, 7 tab, 16 ref.

Descriptors: *Cation exchange, Clay minerals, *Organic matter, Mineralogy, Soil horizons, *Regression analysis, Soil texture.

Regression analyses were used to correlate organic matter, texture and surface area values to the cation-exchange capactiy (CEC) of clay-rich soils in the lowlands of Quebec. The Ap, Bg and Cg

horizons of 11 Gleysolic soils (Aqu-Suborders) were analyzed for CEC, exchangeable bases and acidity, total and fine clay contents, organic matter, surface area and mineralogical composition. The soils contained illite, chlorite, smectite, and vermiculite in addition to quartz and feldspars. In the Ap horizon, total clay and fine clay contents were better related to CEC than organic matter and surface area. In the Bg and Cg horizons, surface area gave the best correlation with CEC. As calculated by multiple regression equations, CEC values of organic matter increased with depth from 56.5 to 223 meq/100 g, while CEC values of total clay decreased from 37.7 to 22.5 meq/100 g and that of fine clay decreased from 57.5 to 50.7 meq/100 g. Variations in the mineralogical composition, although small, were sufficient to explain nearly 50% of the variations in the CEC. (Skogerboe-Colorado State)
W79-06154

ADSORPTION AND EXTRACTABILITY OF MOLYBDENUM IN RELATION TO SOME CHEMICAL PROPERTIES SOIL,
Pahlavi Univ., Shiraz (Iran). Dept. of Soil Science.
N. Karimian, and F. R. Cox.
Soil Science Society of America Journal, Vol. 42, No. 5, p 757-761, September-October, 1978. 3 fig, 4 tab, 32 ref.

Descriptors: *Molybdenum, *Adsorption, *Soil chemistry, Soil tests, Iron oxides, Organic matter, Hydrogen ion concentration, Phosphorus.

Adsorption of Mo from aqueous solutions was determined for eight soils from the Atlantic Coastal Plain and Piedmont regions. The data followed the Feundlich isotherm more consistently than the Langmuir. Adsorption increased as the organic matter and/or Fe oxide contents of the soils increased. Adsorption from an aqueous solution that was initially 0.3 mM Mo (AdMo) also was determined on 32 soils collected from the regions. The AdMo level was positively correlated with Fe oxide and organic matter contents and negatively correlated with pH and P levels. The level of Mo extracted with acid ammonium oxalate (Grigg Mo) and an anion exchange resin (resin Mo) were also determined and related to soil chemical properties and a lime treatment. Grigg Mo was positively correlated with amorphous and free fe oxide by oxalate. Resin Mo was positively correlated with pH but not with other soil properties. Incubating soils with CaCO3 increased the level of rsin Mo. (Skogerboe-Colorado State)
W79-06155

GROUNDWATER RECHARGE AND PALEOCLIMATE IN THE SIRTE AND KUFRA BASINS, LIBYA,
Institute of Geological Sciences, Wallingford (England).
For primary bibliographic entry see Field 2F.
W79-06249

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
M. D. Seymour, S. A. Schubert, J. W. Clayton, Jr., and Q. Fernando.
Water, Air, and Soil Pollution, Vol 10, No 2, p 147-161, August 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Rain water, *Acids, *Rainfall, Sampling, Chemical analysis, Analytical techniques, Chemicals, Acidic water, Hydrogen ion concentration, Volumetric analysis, Precipitation(Analysis), Data processing, Pollutants, Water pollution, Water pollution sources, Pollutant identification, Chemistry of precipitation.

The major acid components in the rainwater collected during 5 different rainfall events in July and August 1977 were found to be a strong acid, the weak acid NH4(+), and dissolved CO2 from the atmosphere. Variations in their concentrations were determined as a function of time in the course of each of the rainfall events. Two experimental methods were used in this investigation, a microtitrimetric method and a coulometric method. The data were analyzed by the use of modified Gran functions. Both methods gave the same results. The most significant observation was that the strong acid concentration increased from very low values to a maximum and then decreased in the course of a single rainfall event. (Sims-ISWS)
W79-06398

CLIMATE,
California State Univ., Long Beach.
For primary bibliographic entry see Field 2B.
W79-06451

OCEANIC AND ATMOSPHERIC VELOCITY FIELDS AND WATER CHEMISTRY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
D. Halpern.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resource Development', Proceedings of Conference/Workshop held in San Francisco, CA, October 22-24, 1976, p 91-97, Jan 1977. 3 fig, 7 ref.

Descriptors: *Baseline studies, *Oceanography, *Meteorology, *Water composition, Chemistry, Resources development, Environmental effects, Path of pollutants, *Outer Continental Shelf, Northern California, Central California, Velocity fields.

Knowledge of the physical environment is an integral part of environmental baseline studies. The trajectory of oil introduced at the surface is determined to a large extent by the space and time variations of the wind and current fields. Accurate interpretation of biological and chemical measurements is dependent upon knowledge of the physical environment. The purpose of this presentation is to describe the richness of the space and time scales of the oceanic and atmospheric velocity fields and water chemistry to be expected in the outer continental region of central and northern California. Because of the scarcity of state-of-the-art physical oceanographic observations within this region, examples are illustrated with data obtained elsewhere. (See also W79-06464) (Sinha-OEIS)
W79-06466

2L. Estuaries

THE HYDRODYNAMICS AND SEDIMENTOLOGY OF A HIGH (TIDAL AND WAVE) ENERGY EMBAYMENT (SWANSEA BAY, NORTHERN BRISTOL CHANNEL),
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
For primary bibliographic entry see Field 2J.
W79-06237

THE DISTRIBUTION OF ORGANIC MATERIAL AND TRACE METALS IN SEDIMENTS FROM THE RIVER LIFFEY ESTUARY, DUBLIN,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
G. B. Jones, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 8, No 1, p 37-47, January 1979. 4 fig, 1 tab, 30 ref.

Descriptors: *Estuaries, *Sediments, *Metals, *Organic matter, Sampling, Data processing, Chemical analysis, Carbon, Nitrogen, Humic acids, Fibers(Plants), Lignins, On-site data collections, Hydrography, Water circulation, Rivers, Sedimentation, *Ireland, *River Liffey Estuary(Ireland).

Sediments of the River Liffey Estuary have been analyzed for organic carbon, Kjeldahl nitrogen, humic acid, and crude fibre contents. Several trace metals also were analyzed. The hydrographic conditions which control the transport of this material also were studied over a tidal cycle. Results indicated that the upper reaches of the estuary are isolated from the incoming seawater and that trace metal enrichment is localized. This metal enrichment is accompanied by an increase in the organic carbon, nitrogen, and humic acid levels. (Sims-ISWS)
W79-06239

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
M. A. Rashid, and G. E. Reinson.
Estuarine and Coastal Marine Science, Vol 8, No 1, p 23-36, January 1979. 9 fig, 3 tab, 26 ref.

Descriptors: *Organic matter, *Sediments, *Estuaries, On-site investigations, On-site data collections, Circulation, Water circulation, Rivers, Coasts, Carbon, Nitrogen, Particle size, Sampling, Pollutants, Water pollution, Water pollution sources, Sedimentation, *New Brunswick(Canada), *Miramichi Estuary(New Brunswick).

The surficial sediments of the Miramichi estuary, New Brunswick, contain a much higher quantity of organic matter than would be expected to occur in an estuary of this type, shallow and well-mixed. The organic carbon distribution, in general, corresponds with the distribution of fine-grained sediment, although higher concentrations occur in sediments of the drowned river channel than in sediments of the bay portion of the estuary. The high quantity of organics in all the sediments and differences in concentrations between river channel and bay sediments are the direct result of the discharge of pulp-mill effluent into the upper reaches of the estuary. The organic carbon isotopic composition of sediments suggest that land-derived material is the predominant source of organics throughout the estuary. Marine organic material is restricted to the sediments near the estuarine mouth. Dispersal of the organic matter is achieved largely by transport in the upper freshwater effluent layer and by settling through the water column when transport energies are reduced. Settling of organic-matter is highest in areas where deposition of fine-grained inorganics prevails. (Sims-ISWS)
W79-06240

TRITIUM AND CARBON-14 DISTRIBUTIONS IN SEAWATER FROM UNDER THE ROSS ICE SHELF PROJECT ICE HOLE,
Scripps Institution of Oceanography, La Jolla, CA.
R. L. Michel, T. W. Linick, and P. M. Williams.
Science, Vol 203, No 4379, p 445-446, February 2, 1979. 2 tab, 15 ref. NSF DPP76-22134, DPP77-20579, OCE77-17567, EAR76-22623.

Descriptors: *Tritium, *Carbon radioisotopes, *Sea water, *Antarctic, Ice, Cold regions, Isotope studies, Pollutants, Pollutant identification, Circulation, Water circulation, Oceans, Oceanography, *Ross Ice Shelf, *Ross Sea.

The tritium and carbon-14 activities of seawater samples collected from 22 to 200 meters below the ice at the Ross Ice Shelf Project ice hole were reported. The tritium results showed that the waters below the ice have exchanged with Ross Sea water since the advent of nuclear testing. The carbon-14 results indicated that waters in the upper layer exchange in time periods of less than 6 years. Measurements of these isotopes in seawater under the Ross Ice Shelf in McMurdo Sound showed that this water has a different history. (Sims-ISWS)
W79-06241

OCEAN TIDE AND WAVES BENEATH THE ROSS ICE SHELF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
R. T. Williams, and E. S. Robinson.
Science, Vol. 203, No. 4379, p 443-445, February 2, 1979. 2 fig, 1 tab, 12 ref. NSF GV-40434, DPP73-05873.

Descriptors: *Tides, *Waves(Water), *Antarctic, Ice, Ocean waves, Tidal waters, On-site investigations, On-site data collections, Data processing, Oceans, Oceanography, *Ross Ice Shelf, *Ross Sea.

The ocean tide in the southern Ross Sea is principally diurnal. The trophic tide range (double amplitude) is between 1 and 2 meters, depending on the location, and is closely related to the local water-layer thickness. The range of the tropic tide is more than 3 times the range of the equatorial tide. Cotidal and coamplitude charts were made for the largest diurnal constituents, K sub 1 and O sub 1, and a provisional cotidal map was made for the semidiurnal constituent M sub 2. The amplitudes of the diurnal tide constituents are larger in the Ross Sea than in the adjacent southern Pacific Ocean, indicating the existence of a diurnal resonance related to the shape and depth of the sea. Waves related to ocean swell propagate into the ice-covered region from the northern Ross Sea. These waves have amplitudes near 1 centimeter, and periods in the range 1 to 15 minutes. The speed at which these waves travel is successfully predicted by flexural wave theory. (Sims-ISWS)
W79-06242

CIRCULATION AND MELTING BENEATH THE ROSS ICE SHELF,
Lamont-Doherty Geological Observatory, Palisades, NY.
S. S. Jacobs, A. L. Gordon, and J. L. Ardai, Jr.
Science, Vol 203, No 4379, p 439-443, February 2, 1979. 3 fig, 27 ref. NSF C-726, 76-11872, 77-22209.

Descriptors: *Water circulation, *Melting, *Water temperature, *Salinity, *Antarctic, Cold regions, Temperature, Circulation, Density, Ice, On-site data collections, Data processing, Oceans, Measurement, Oceanography, *Ross Ice Shelf.

Thermohaline observations in the water column beneath the Ross Ice Shelf and along its terminal face show significant vertical stratification, active horizontal circulation, and net melting at the ice shelf base. Heat is supplied by seawater that moves southward beneath the ice shelf from a central warm core and from a western region of high salinity. The near-freezing Ice Shelf Water produced flows northward into the Ross Sea. (Sims-ISWS)
W79-06243

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W79-06295

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
For primary bibliographic entry see Field 5C.
W79-06467

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MECHANISM AND PREVENTION OF REVERSE OSMOSIS MEMBRANE FOULING,
Midwest Research Inst., Minnetonka, MN. North Star Div
J. E. Cadotte, and R. J. Peterson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 630, Price codes: A02 in paper copy, A01 in microfiche. September 30, 1977. 3 p. DAAG29-76-C-0053.

Descriptors: *Reverse osmosis, *Desalination, *Desalination processes, *Membrane fouling, *Desalination apparatus, *Membrane processes, *Pollutants, Colloids, Pollutant identification, Flocculation, Filtration, Clays, Chlorine, Organic compounds, Inorganic compounds, Water treatment, Water purification.

Information concerning the deposits which foul reverse osmosis membranes is abstracted from two unpublished papers. Testing revealed that colloidal and dissolved constituents of naturally occurring surface waters were the cause of membrane fouling. Although clays and inorganic colloids are easily removed from feedstreams by polymeric flocculation and sand filtration the organic colloids are more difficult to remove. The surface analysis techniques, electron spectroscopy, Auge electron spectroscopy, and scanning electron microscopy, were used to characterize membrane deposit from Potomac River water and sea water feeds. The three approaches selected to reduce membrane fouling were: (1) improvement in pretreating the feedwater; (2) complexing the organic colloids with the addition of cationic polymers to the feed water; and (3) modification of the membrane surface to decrease the adherence of the foulants. Effort was concentrated on the first method. The pretreatment process involves the addition of an organic polymer flocculating agent followed by sand filtration. Alum and ferric chloride, coagulating agents, were used in conjunction with organic polymer flocculants; ferric chloride appeared better for removing organic colloids from river water. A pretreatment process for river water was developed in which the raw water was pretreated with 10 ppm of chlorine and 10 to 50 ppm of chlorine and 10 to 50 ppm ferric chloride. The pH of the water was adjusted to 5.5 with sulfamic acid which complexed the chlorine so that it did not oxidize the membrane. (Davison-IPA)
W79-06079

RESEARCH ON AND DEVELOPMENT OF ION-SELECTIVE AND ION-SPECIFIC MEMBRANES FOR USE IN THE LARGE-SCALE, LOW-COST DEMINERALIZATION OF SALINE WATERS BY SELECTIVE ELECTRODIALYSIS.
Polytechnic Inst. of New York, Brooklyn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 694, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 37, May 1960. 77 p, 6 fig, 11 tab, 35 ref. 14-01-001-62.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Membrane processes, Permeability, Fabrication, Ion transport, Specific retention, Laboratory tests, Selectivity, Diffusion, Sulfates, Ions, Chlorides, Distillation, Electrodialysis, Separation techniques, Water treatment, Desalination processes, Water purification, Saline water, Brackish water.

An investigation of known membrane systems which might be more permeable to sulfate than to chloride, and the attempt to prepare membranes of improved specificity are reported. A membrane of improved specificity would be useful in removing sulfate from a chloride-sulfate solution in which the sulfate content is too high, or to fractionate a mixture of the ions into two solutions with each solution containing only one ion. The commercial membranes, Nalfilm 2 and Nalfilm 4 were investigated. Compounds presumed to be specific to sulfate were utilized in the preparation of membranes with improved specificity. Impregnated membranes made from o-phenylene-diamine and benzidine and polymerized on Polypor PVA formaldehyde were tested along with four hetrogeneous membranes prepared with anion exchange resins in a Dynel matrix. The tests to determine specificity included measurements of the bi-ionic potentials, conductance, selectivity ratios, diffusion coefficients, and direct measurement of the transport numbers in brackish water. The resulting data is tabulated. Although the tests indicated that membranes can be prepared from material specific to sulfate, the membranes showed no transport specificity. The technique of preparing a sulfate specific membrane by incorporating Benzidine-Formaldehyde in an inert matrix was insufficient because the resin bound the sulfate too strongly. (Davison-IPA)
W79-06082

DEVELOPMENT OF THE ZONE-PURIFICATION PROCESS FOR PREPARING POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
W. H. Mink, G. F. Sachsel, and R. B. Filbert, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 766, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 39, June 1, 1960. 30 p, 10 fig, 2 tab, 4 append. 14-01-001-175.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Zone-purification process, *Freezing, Economics, Estimated costs, Computer models, Sea water, Potable water, Analog models, Water purification, Water treatment, Separation techniques, Tubes, Refrigeration, Temperature control.

The vertical-tube zone-void refiner was selected as the apparatus in which the zone-purification process could operate in a continuous manner. In this unit a number of vertical tubes pass through closely spaced, horizontal plates. With the spaces between the plates connected by automatic values to either the heating or cooling part of a refrigeration system, it is possible for any space to be a melting or freezing zone. The freezing and melting zones move upward along the tube by selective operation of the valves. As the sea water introduced near the top of the tube passes down the tube, it is subjected to a zone purification as it passes a freezing zone. Purified water leaves the bottom of the tube, and salt is concentrated as brine at the top to be periodically removed by flushing with fresh sea water. Information obtained from an analog computer simulation of the unit and additional experimental freezing data show that the optimum vertical-tube would require four stages, freeze 13% of the feed, and require a temperature difference in the freezing zones of 3F. The estimated capital costs for plant producing 100,000 gallons of potable water/day were $2,600,000, with operating costs estimated at $9.60/1000 gallons of potable water. Capital and operating costs for a 10 million gpd plant were estimated at $115,000,000 and $4.21/1000 gallons, respectively. It is concluded that these costs are not likely to be reduced with major changes in the process. (Davison-IPA)
W79-06083

DEVELOPMENT, CONSTRUCTION, AND TESTING OF OSMIONIC DEMINERALIZERS,
Southern Research Inst., Birmingham, AL.
R. E. Lacey, E. W. Lang, and C. E. Feazel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 862, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 38, June 1960. 94 p, 26 fig, 11 tab, 8 ref. 14-01-001-88.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Osmionic demineralizers, Testing, Laboratory tests, Equations, Membranes, Membrane processes, Physical properties, Physicochemical properties, Materials, Demineralization, Cost comparisons, Estimates costs, Separation techniques, Water treatment, Water purification, Brackish water.

Two bench-scale demineralizers based on the osmionic process were developed to determine whether these units could be built by methods amenable to mass production, and whether the demineralization rates obtainable in such units are rapid enough to be of practical interest. In Part A the important results of the project are summarized

and the current status of the osmionic process is reported. In Part B the work is discussed in detail. Alterations in the original Murphy Design equations are discussed and the electrochemical and physical properties of osmionic membranes are examined. The following special testing programs important to the design of osmionic units are discussed: (1) testing of bonds between membranes; (2) polarization or boundary-layer effect; (3) pressure drop and solution distribution within membrane compartments; (4) evaluation of gasket materials for the second bench-scale demineralizer; and (5) leakage of ions through membranes. Details of both bench-scale demineralizers are given. The estimated costs of demineralization based on the osmionic process appear to be competitive with those of other processes. (Davison-IPA)
W79-06084

EVALUATION OF THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
R. C. Himes, S. E. Miller, W. H. Mink, and H. L. Goering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 818, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 36, May 1960. 32 p, 8 fig, 5 tab. 14-01-0001-80.

Descriptors: *Desalination, *Desalination processes, *Zone-purification process, *Freezing, *Ice-water interfaces, Interfaces, Crystal growth, Crystallization, Demineralization, Equipment, Mechanical equipment, Saline water, Potable water, Evaluation, Separation techniques, Water purification, Water treatment.

Continuing work is reported in understanding the phenomena which occur during freezing to establish optimum conditions for segregation of salt and to determine the most suitable conditions for large scale utilization of the zone purification process. Studies on water-ice interface shape were concentrated on the investigation of mechanical stirrers and a continuous flow-type apparatus for providing fluid measurement near the interface. These studies have shown that the shape of the interface is important in determining the nature of the ice deposited. High segregation efficiency was obtainable by promoting the growth of ice crystals from the center of the freezing tube toward the periphery in place of the normal growth which is inward from the periphery. Experimental details are given for studies on interface shape, rate of crystallization of ice from salt solutions, microscopic examination of pulled ingots, constitutional super cooling, multiple-stage freezing, efficiencies of segregation in multiple-stage freezing and crystal-pulling experiments. Preliminary engineering evaluation and detailed engineering treatment are discussed. It is concluded that periodic salt entrapments are linked with breakdown of constitutional supercooling. The technical feasibility of multiple-stage zone-freezing conversion of sea water was demonstrated, and perhaps the vertical tube system of the several multiple-stage continuous freezing systems evaluated may be economically feasible. (Davison-IPA)
W79-06085

FURTHER DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE CONVERSION,
Carrier Corp., Syracuse, NY.
C. M. Bosworth, S. S. Carfagno, A. J. Bardhun, and D. J. Sandell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 403, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 32, July 1959. 78 p, 15 fig, 7 tab, 8 append. 14-01-001-86.

Descriptors: *Desalination, *Desalination processes, *Freezing, Laboratory tests, Equipment, Costs, Capital costs, Operating costs, Water costs, Separation techniques, Desalination apparatus, Design criteria, Water treatment, Water purity.

An experimental program is reported wherein the operational variables of a direct freezer and wash separation column are determined for the purpose of designing a pilot plant. Recent modifications to the experimental equipment resulted in an increased capacity of about 400 gpd with an acceptable amount of wasted wash water. Project activity is reported for September 1 to November 30, 1958 and activity for period October 15, 1957 to November 30, 1958 is summarized. Experimental freezing and separation results are presented. A pilot plant using an absorption refrigeration machine for water vapor removal was designed to produce 15,000 gpd of fresh water from sea water. Total estimated costs for fabrication, assembly and leak testing is $150,000. Estimated capital costs are presented for single effect plants with capacities of 15,000 gpd, 100,000 gpd, 500,000 gpd, and 10,000,000 gpd. The cost of water produced by these plants was estimated to be economical with steam available at $.25 or less/MBtu and $.55/MBtu, or electrical power available at $.007/kwhr. The single effect absorption machine is expected to produce less expensive water than the three effect machine if waste steam cost is less than $.15/MBtu. (Davison-IPA)
W79-06086

THIN FILM VAPOR COMPRESSION SALINE WATER CONVERSION SYSTEM,
Westinghouse Research and Development Center, Pittsburgh, PA.
A. Willenbrock, Jr., R. M. Chamberlin, D. R. Fraser, G. E. McGinnis, and J. A. Cyphers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 582, Price codes: A15 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 85, February 1964. 323 p, 104 fig, 13 tab, 17 ref, 5 append. 14-01-0001-273.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Thin film vapor compression, Evaporation, Thin films, Heat transfer, Technology, Economics, Cost comparisons, Materials, Separation techniques, Water treatment, Water purification, Saline water.

A research and development program is reported wherein the critical areas of a proposed thin film vapor compression system were examined and evaluated. The five tasks involved in the program included: (1) determining the characteristics of an adequate saline water evaporating film flowing on a vertical or nearly vertical flat surface; (2) developing the technology to create and maintain this film; (3) determining of minimum cost materials consistant with environment, life and manufacturing requirements; (4) developing improvements in heat transfer by specially formed surfaces; and (5) evaluating the manufacturing techniques in fabricating the heat transfer surface. The technical assumptions were verified experimentally; the required developments were accomplished; the economic assumptions were studied and reevaluated; and the technology was attained to design a pilot plant. It is concluded that a one million gpd thin film vapor compression sea water conversion system could be built which would produce water at comparable costs of current multi-stage flash plants. (Davison-IPA)
W79-06087

CONTINUATION OF MATERIALS EVALUATION PROGRAM,
Rice (Cyrus William) and Co., Pittsburgh, PA.
H. C. Bramer, W. E. Bell, R. E. Moore, D. R. Surdock, and D. R. Brenneman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 020, Price codes: A13 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 535, March 1970. 283 p, 34 fig, 32 tab, 14 ref, 1 append. 14-01-0001-1657.

Descriptors: *Desalination, *Materials Evaluation Report Form, *Desalination apparatus, *Materials testing, *Evaluation, *Information retrieval, Corrosion, Tubes, Steel pipes, Linings, Coatings, Plastic, Rubber, Laboratory tests, Water treatment, Separation techniques, Desalination plants.

The on-going testing of construction materials and equipment at test bed plants and other facilities operated by the Office of Saline Water Research is reported. In response to the need for a centralized and coordinated program for reporting corrosion information, the Materials Evaluation Report Form (MERF) was developed. This complete information handling and retrieval system for the information generated during field inspections, from nondestructive testing, from corrosion testing in the laboratory, from laboratory analyses, and other sources is described. Details of testing in the following areas are given: tubing materials in all test bed plants, corrosion specimens in side stream loops, corrosion deposition as a function of dissolved oxygen, and carbon steel erosion-corrosion. Selected tubing materials in all test bed plants were tested using the Probolog Instrument. In high maintenance areas requiring frequent repair and replacement carbon steel piping the use of fiberglass reinforced plastic piping and plastic lined light gauge steel or aluminum piping seems economically justified. Recommendations are made for further research in these areas and the area of waterside technology as related to saline water conversion equipment performance. (Davison-IPA)
W79-06088

FABRICATION OF SMOOTH TUBES FOR LARGE MULTISTAGE FLASH EVAPORATOR DESALINATION PLANTS,
Oak Ridge National Lab., TN.
F. J. Moran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 024, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 540, March 1970. 176 p, 25 fig, 7 tab, 3 ref, 6 append. 14-01-0001-534.

Descriptors: *Desalination apparatus, *Tubes, *Fabrication, *Industrial production, *Copper alloys, Desalination processes, Multiple-stage flash evaporation, Titanium, Water treatment, Water purification, Separation techniques, Desalination.

A study with the following objectives is presented: (1) to ascertain the present state of the art of fabricating copper-nickel and titanium alloy condenser tubing and (2) to stimulate industry development of improved methods. The scope involved performing a continuous evaluation of the state of the art; developing specifications for fabricating reliable low-cost tubing; evaluating improved methods for fabricating seamless and welded tubes; and surveying eddy-current and ultrasonic types of tube testing instruments, and determining their suitability for high-speed, in-line testing of smooth tubes for desalination plants. The state of the art has remained static because the market for condenser tubes has not been large enough to justify the capital investment needed to produce copper-alloy tubes by the most advanced methods, and because the relatively short lengths required in heat exchanges could be produced on conventional draw benches keeping the more efficient production units occupied with supplying the growing demand for unalloyed copper tubing. The production methods, limitations and costs of copper-alloy tube production are summarized. The development of improved production of copper-nickel tubes, and its estimated costs are discussed. Welded tube fabrication, quality control, specifications for copper-nickel tubing for multi-stage flash (MSF) plants, splicing of tubes for use in MSF plants, improved production processes for titanium tubes, and welding of titanium tubes to titanium-clad steel tube sheets are examined. (Davison-IPA)
W79-06089

AN INVESTIGATION OF THE TRANSPORT PROPERTIES OF ION EXCHANGE MEMBRANES,
Little (Arthur D.) Inc., Cambridge, MA.
J. H. B. George.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-179 945, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 159, December 1965. 36 p, 2 fig, 13 tab, 10 ref. 14-01-0001-372.

Descriptors: *Desalination, *Membrane processes, *Cation exchange, *Conduction, Conductivity, Transfer, Water conveyance, Activation energy, Measurment, Temperature, Aqueous solutions, Testing, Testing procedures, Water treatment, Water purification, Separation techniques.

Experimental data on the specific conductance of a polystyrene-sulfonate cation exchange membranes and water transfer accompanying the passage of ions through the membrane are presented. The conductance measurements were carried out at 10, 25, and 40C; equivalent conductances and energies of activation were calculated for the conduction process. It was found that equivalent conductances of ions in the membranes are lower than the corresponding values in free aqueous solution; the effect is much greater for multivalent ions. Water transfer measurements were made under conditions corresponding to those used for conductance measurements. Although water transfer/equivalent varied correspondingly with charge type, the water transfer/mole of ion showed similar values for all ions studied, except the heavily hydrated lithium ion which showed larger values. Water transfer, independent of temperature for monovalent ions, decreased with temperature for divalent and trivalent ions. The data were combined with estimated values for ionic self-diffusion coefficients in the membrane to calculate friction coefficients for the interactions between membrane, counterion, and water. The usefulness of the numerical values is limited by assumptions which must be made in the derivation. (Davison-IPA)
W79-06090

REVERSE OSMOSIS MEMBRANE RESEARCH,
General Atomic Co., San Diego, CA.
V. Merten, H. K. Lonsdale, R. L. Riley, and K. D. Vos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-180 322, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 265, August 1967. 197 p, 54 fig, 44 tab, 76 ref, 1 append. 14-01-001-767.

Descriptors: *Desalination, *Desalination apparatus, *Reverse osmosis, *Membranes, *Membrane processes, Thin films, Semipermeable membranes, Compaction, Cellulose acetate, Polymers, Ion transport, Water purification, Water treatment, Separation techniques, Brackish water, Plastics, Saline water.

Several areas of research on the properties and performance of cellulose acetate membranes in reverse osmosis desalination, and the development and evaluation of improved membranes are summarized. The two significant limitations of the use of modified cellulose acetate membranes, membrane compaction and lifetime, were studied. The study of the decline in water flux with time indicates that flux decline probably results from morphological changes in membrane substructure. Membrane life studies conducted on simulated brackish water and on San Diego tap water allow predictions of membrane life to be tested based on previous studies of the pH-dependence of the hydrolysis rate of cellulose acetate. In studies of the thin-film method for preparing high-flux cellulose acetate membranes, two membranes produced with no imperfections exhibited 99.8% sodium chloride rejection. Attention was concentrated on the interpolymer of ethyl cellulose and polyacrylic acid and ion exchange membranes in the study of alternate membrane materials. The study of models of transport phenomena in membranes includes coupled flow in solution-diffusion membranes and the finely-porous, fixed-charge membrane. Immersion, direct osmosis, and reverse osmosis experiments show that phenol and water are strongly coupled in flowing through cellulose acetate membranes. Negative rejection of phenol was observed in reverse osmosis. (Davison-IPA)
W79-06091

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Midland, MI.
M. A. Zeitoun, E. F. Mandelli, W. F. McIlhenny, and R. O. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-203 857, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 437, March 1969. 203 p, 40 fig, 56 tab, 110 ref, 5 append. 14-01-0001-1161.

Descriptors: *Desalination, *Effluents, *Desalination wastes, *Environmental effects, *Temperature, *Salinity, *Copper, Phytoplankton, Diatoms, Dinoflagellates, Heat, Water treatment, Separation techniques, Physical properties, Chemical properties, Sea water, Desalination plants.

In estimating the ranges in chemical and physical properties of the effluents from large dual-purpose plants, the copper concentration in the effluents, the dispersion of effluents in the marine environment, and the ecological effects of the effluents were studied. Through analysis of the process streams of three desalination plants it was found that copper was more soluble in sea water concentrates than in sea water, with a minimum solubility at pH 7.5. Since the mixed effluent from a desalination plant is more dense than the receiving water, it tends to sink to the ocean floor. The theoretical aspects of a vertical jet of dense fluid were studied numerically and analytically. Experimental results obtained through using a laboratory model indicate that a dissolved constituent of the jet fluid would spread more rapidly in the lateral direction inside the core of the jet than momentum, and the constituent would spread more slowly than momentum in the outer region. Increasing temperatures in coastal waters tend to produce a simplification of the phytoplankton structure of the environment. A continuous supply of copper concentrations of about 0.05 ppm at 20C was found to be toxic to diatoms and dinoflagellates. Increasing temperatures increased the toxicity of copper to marine phytoplankton, while increasing salinities were found to have an antagonistic action on the toxicity of copper to them. (Davison-IPA)
W79-06092

PILOT PLANT TESTS AND DESIGN STUDY OF A 2.5 MGD HORIZONTAL-TUBE MULTIPLE-EFFECT PLANT.
Universal Desalting Corp., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 905, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 492, October 1969. 156 p, 35 fig, 6 tab, 15 ref, 3 append. 14-01-0001-1707.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, Horizontal tube multiple effect distillation, Evaluation, Heat transfer, Feasibility, Costs, Operating costs, Capital costs, Water costs, Water treatment, Water purification, Separation techniques, Design criteria, Wrightsville Beach(North Carolina).

In a new concept of multiple effect distillation equipment, the heat transfer tubes are horizontal with steam condensing on the inside and brine boiling on the outside; the effects are arranged vertically. The extensive tests conducted at the Wrightsville Beach, North Carolina, pilot plant show that the smooth horizontal tubes yield heat transfer coefficients which are 50 to 100% higher than those of smooth vertical tubes; however, the vertical arrangement with gravity flows eliminates all intereffect pumps and associated equipment. Design parameters were determined using this concept, and a 2,500,000 gpd plant was designed in sufficient detail to prepare reliable cost estimates. The total installed capital cost is $1,625,500, capital cost/gallon stream day is $.65, and operating cost/1000 gal is $.537. Detailed drawings of the 2.5 MGD horizontal tube multiple effect plant are provided. (Davison-IPA)
W79-06093

DEVELOPMENT OF PRECIPITATION PROCESSES FOR REMOVAL OF SCALE FORMERS FROM SEA WATER.
Grace (W. R.) and Co., Clarksville, MD. Washington Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-185 171, Price codes: A21 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 192, May 1966. 487 p, 86 fig, 143 tab, 22 ref, 11 append. 14-01-0001-323.

Descriptors: *Desalination, *Desalination process, *Evaporation, *Precipitation(Chemical), *Pretreatment(Water), Scaling, Phosphates, Calcium carbonate, Lime, Calcium compounds, Fertilizers, Phosphorus compounds, Separation techniques, Water treatment, Water purification, Water quality, Water quality control, Desalination apparatus.

The Wrightsville Beach pilot plant equipment was used to verify the laboratory work which developed the phosphate precipitation for removing calcium from sea water and producing a phosphatic byproduct raw material for the manufacture of fertilizer. The lime-magnesium carbonate (LMC) process for removing calcium from sea water was also tested on this equipment. Each process is described and, the laboratory studies and pilot plant operations for both are examined; the byproduct of the phosphate precipitation process is evaluated. Capital and manufacturing costs for both processes are discussed, as well as for byproduct recovery. It was shown that it is technically feasible to precipitate out all the magnesium and up to 99% of the calcium present in sea water by phosphate precipitation on a continuous pilot plant basis. It was also shown by pilot plant operation that the addition of magnesium carbonate trihydrate in the presence of calcium carbonate seeds, followed by lime, will precipitate up to 65% of calcium from sea water. It is concluded that in a single effect, forced circulation evaporator operating at 275F and 7/1 brine concentration, water treated by phosphate precipitation produced absolutely no scale; negligible deposits of calcium carbonate occurred, but a light coating of Mg(OH)2 and CaSO4 anhydrite was deposited in the heater tubes when sea water treated with calcium was fed to a single effect, forced circulation evaporator for 500 hours at 270F and 1.9 concentrations. (Davison-IPA)
W79-06094

WET-END SHOWERS AND WHITE WATER SHOWER SYSTEM CONSIDERATIONS,
Albany Engineered Systems, Glens Falls, NY.
H. R. Bissell.
Tappi (Atlanta, GA) Seminar Notes on Wet-End Operations, New Orleans, May 14-19, 1978, p 97-103. 1 appendix, 3 fig, 5 ref.

Descriptors: *Water reuse, *White water(Paper machines), Water pollution sources, Pulp wastes, Recycling, Industrial water, Pulp and paper industry, Effluents, Water conservation, Operation and maintenance, Corrosion control, Scaling, Slime, Filters, Valves, Pipelines, Storage tanks, Paper machines, Showers, Closed systems.

An important aspect of closing the paper-machine water system is the increased use of recycled water in shower sprays. Operating problems of such showers involve plugging or clogging of nozzles. Showers specifically designed for minimizing such troubles (self-cleaning or purgeable nozzles) are described, along with other components of the white water recirculation system (gravity strainers, white water chests or tanks, piping, flush valves, in-line pressure filter, etc.) and maintenance considerations (for control of corrosion, scale, and slime deposits). (Brown-IPC)
W79-06117

SALINE WATER CONVERSION BY DIRECT FREEZING WITH BUTANE,
Blaw-Knox Co., Pittsburgh, PA.
G. Karnofsky, and P. F. Steinhoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 819, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 40, July 1, 1960. 67 p, 16 fig, 9 ref. 14-01-001-176.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Freezing, *Cornell process, *Economics, Costs, Estimated costs, Engineers estimates, Capital costs, Water costs, Water treatment, Separation techniques, Water purification, Sea water.

Laboratory work is the basis for an engineering study of a 10,000,000 gpd plant to produce fresh water from sea water using a system known as the Cornell Process. In this process, direct freezing is brought about by evaporation of a hydrocarbon refrigerant, butane, in contact with sea water. The ice is washed free of saline liquor, and then melted to potable water by the condensation of butane vapor. The total estimated cost for a plant utilizing electric drive is $10,524,000; product water cost is $.555/1000 gallons. For a plant using gas engines for the compressors, the capital investment is $11,874,000; product water cost is $.507/1000 gallons. While brackish water was not considered it is estimated that the cost of converting it would be $.10 less/1000 than sea water conversion. The engineering design is based on laboratory work which closely imitated a large scale operation. A flow diagram includes every major equipment item necessary in a complete plant. (Davison-IPA)
W79-06268

SOLAR STILL CONSTRUCTION,
New York Univ., NY. Engineering Research Div.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 404, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 33, August 1959. 21 p, 4 fig, 1 tab. 14-01-001-68 and 14-01-001-102.

Descriptors: *Desalination, *Desalination apparatus, *Solar distillation, *Solar stills, *Evaporation, Equipment, Design criteria, Structural design, Fabrication, Water yield, Efficiencies, Separation techniques, Water treatment, Water purification, Saline water, Solar radiation.

Specification and designs of the glass covered flat, tilted solar still and a multiple effect solar still are presented. The structural components and operation of the stills are described. Tilted surfaces receive more solar radiation than horizontal surfaces. The optimum year around tilt is equal to the geographical latitude. At the Office of Saline Water test installation in Daytona Beach, Florida, a tilt of 25 degrees from the horizontal facing south is most favorable. Theoretically, the maximum water yield is computed by using the factor of 1070 Btu/lb of water and assuming a 100% efficiency of the total solar energy used for evaporation. This efficiency cannot be attained by single effect stills because of inherent losses in transmission and operational heat loss, and heating of excess feed water. The multiple effect still presented combines the collection of solar energy with a 10 effect still tilted at 25 degrees from the horizontal. It is estimated that the efficiency of the 10 effect still is six times greater than a single effect of equal solar energy intercepting area. Drawings of the flat tilted still and the multiple effect still are provided. (Davison-IPA)
W79-06269

REMOVAL OF SCALE-FORMING COMPOUNDS FROM SEA WATER,
Grace (W. R.) and Co., Clarksville, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 406, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 66, September 1962. 100 p, 19 fig, 44 tab, 36 ref. 14-01-001-202.

Descriptors: *Desalination, *Pre-treatment(Water), *Descaling, *Fertilizers, Ammonium compounds, Phosphates, Scaling, Economic feasibility, Sea water, Trace elements, Water analysis, Water chemistry, Water treatment, Desalination plants, Research and development, Water quality, Water quality control, Distillation.

An investigation was undertaken to determine the economic feasibility of preparing a high analysis fertilizer from the scale-forming elements removed in the pretreatment of raw sea water, and to determine the ore potential of sea water. Magnesium, calcium and the trace elements, iron, zinc, copper, manganese and cobalt were precipitated from sea water as metal ammonium phosphates and other phosphates with phosphoric acid and ammonia. The descaled sea water was ready to be used in a water conversion plant. The slurry of precipitated solids, i.e., fertilizer was dehydrated by heating, then filtered, washed, granulated and dried. This fertilizer has low solubility, is non-burning, non-leaching and long acting. Assuming a descaling of one mgpd capacity the fertilizer produced would have to command a price higher than that of conventional fertilizers unless a reduction in the cost of raw materials is achieved through technological improvements. It is anticipated that various other metals will eventually be separated from sea water or the waste evaporator brine. Future metal recovery processes may utilize the fertilizer produced by this process as a raw material. (Davison-IPA)
W79-06270

EFFECTS OF IMPRESSED ELECTROSTATIC FIELDS ON THE SALT WATER/AIR INTERFACE,
Tracor, Inc., Austin, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 407, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 67, September 1962. 54 p, 18 fig, 2 tab, 20 ref. 14-01-001-200.

Descriptors: *Desalination, *Desalination processes, *Electrophoresis, Interfaces, Boundaries, Air-water interfaces, Separation techniques, Measurement, Surface tension, Drops, Electrodes, Desalination apparatus, Salinity, Saline water, Impressed electrostatic fields, Water treatment, Water purification.

Surface tension changes were measured after electrostatic fields of up to 6700 v/cm, positive and negative, were applied to air/NaCl-solution interfaces; salt concentration ranged from 0 to 3.5%. The surface tension of all solutions investigated was lowered by both field directions, with the positive air electrode lowering the surface tension of pure water less than a negative air electrode. It now appears that the field at the air-water interface is smaller than the 10 to the seventh vcm previously thought present, that the orientation of the water dipoles at the interface is slight, and that the predominant small orientation present is with the hydrogen atoms facing the air. Data from calculating the surface deficiency of NaCl solutions under applied electric fields with the Gibbs equation show that a positive air electrode increases the surface deficiency and a negative air electrode decreases it. An attempt to use a skimming apparatus to measure directly the surface concentration change revealed that its usefulness depended on the ability to analyze the skimmed and unskimmed position with accuracy. This was not possible for NaCl solutions up to 3.5%. It is concluded that surface concentration changes of NaCl solutions due to applied electrostatic fields are too small to be measured quantitatively and are unsuitable for practical desalination processes. (Davison-IPA)
W79-06271

TEMPERATURE DISTRIBUTION IN THE CRYSTALLIZATION OF UNDERCOOLED LIQUIDS IN CYLINDRICAL TUBES,
Massachusetts Inst. of Tech., Cambridge.
P. L. T. Brian, and P. R. Sperry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 673, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 98, May 1964. 50 p, 6 fig, 3 tab, 13 ref, 5 append. 14-01-0001-295.

Descriptors: *Desalination, *Crystallization, *Temperature, *ice-water interfaces, Boundaries(Surfaces), Boundary layer, Crystals, Growth rate, Nucleation, Supercooling, Separation techniques, Laboratory tests, Heat transfer, Equations, Numerical analysis, Water treatment, Water puification.

An analysis of the planar interface morphology observed in capillary crystallization experiments is discussed. One technique for determining crystallization kinetics of undercooled liquids consists of nucleating a seed crystal with the desired crystallographic orientation in one end of a capillary tube filled with the liquid under investigation. After nucleation the preparation is placed in a bath held at a constant temperature below the equillibrium freezing point of the liquid. The rate of crystal growth is determined by measuring the position of the solid-liquid interface as a function of time. When the temperature of the cooling bath is adjusted to correspond to various degrees of supercooling the curve showing the dependence of growth rate of the crystal face on undercooling can be obtained with one seed crystal. The temperature at the crystal-liquid interface is greater than the temperature of the cooling bath, because the latent heat of fusion is liberated at the interface during crystal growth. A planar interface for crystals growing normal to the hexagonal basal plane was observed. Numerical values of interface temperature rise as a function of the parameters of the capillary crystalization experiment are presented. (Davison-IPA)
W79-06272

RESEARCH ON SALINE WATER CONVERSION BY FREEZING,
Massachusetts Inst., of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 593, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 96, March 1964. 52 p, 14 fig, 20 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Laboratory tests, Laboratory equipment, Membranes, Crystallization, Mathematical studies, Ice-brine interfaces, Saline water, Salinity, Water treatment, Water purification, Separation techniques.

The progress of three investigations in the research related to freezing as a desalination process are reported: (1) a study of the effect of salt build-up at a phase boundary across which water only is removed from brine; (2) an experimental and theoretical study of counter-current washing to remove brine from ice-brine 'slush'; and (3) a basic study of the effect of additives on crystallization of supercooled water. In an experimental study of the salt buildup phenomena, a porous hollow rotating cylinder coated with an osmotic membrane is used to separate water from salt solution with pressure applied to the external salt solution. Two preliminary experiments made with cellulose acetate membranes showed that the equipment operated satisfactorily. The washing investigations carried out on glass and plastic beads and batch washing of brine from a mass of small ice crystals are described. A summary of mathematical analysis of experiments to determine the interface temperature in capillary crystallization experiments is presented. Background information in these areas from the literature is discussed. (Davison-IPA)
W79-06273

STUDY OF MULTI-PHASE EJECTORS FOR DISTILLATION DESALINATION SYSTEMS,

Kaye (Joseph) and Co., Inc., Cambridge, MA.
C. A. Kemper, G. F. Harper, S. W. Gouse, and J. H. Leigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 594, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 97, January 1964. 80 p, 25 fig, 9 ref, 3 append. 14-01-0001-329.

Descriptors: *Desalination, *Desalination processes, *Evaporation, *Multi-phase ejectors, Physical properties, Temperature, Energy, Differential thermal analysis, Friction, Viscosity, Pumps, Performance, Vapor compression distillation, Water treatment, Water purification, Separation techniques.

The results of this detailed, theoretical study of single stage evaporation system incorporating a multi-phase ejector (MPE) to achieve the driving temperature difference, can be interpreted in terms of various vapor evaporation systems or various freezing systems. Evaporator temperatures of 150 to 350F and evaporator temperature differences of 5 and 10F were used, and the effects of pump efficiency, viscous friction, and mixing irreversibility in the MPE were considered. For given operating conditions pure work-input MPE desalination systems were the most attractive from an overall energy requirement basis when 25% efficiency was assumed for the heat engine producing the required work-input. Upon examining the possibility of staging various types of MPE desalination systems, it was found that pure work-input systems would most likely be operated as single stage systems. The results of comparing an ideal pure work-input MPE system and a reversible adiabatic vapor compression system indicate that the MPE system is more attractive on a work-input basis. Economically, it would be less costly to replace the liquid pump of the MPE system than to replace a vapor compressor. MPE desalination systems are described, and the analytical methods used, and discussions of the results are presented in the appendices. (Davison-IPA)
W79-06274

SALT CONCENTRATION AT PHASE BOUNDARIES IN DESALINATION PROCESSES,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, P. L. T. Brian, and R. E. Fisher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 592, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 95, March 1964. 51 p, 8 fig, 2 tab, 16 ref, 1 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Salt build-up, Membranes, Membrane processes, Reverse osmosis, Osmosis, Osmotic pressure, Flow, Mass transfer, Boundary processes, Boundaries(Surfaces), Flow resistance, Flow separation, Laminar flow, Turbidity, Separation techniques, Water treatment, Water purification.

The theory of the salt build-up phenomena is examined. Salt build-up can be serious in water removal by freezing, solvent extraction and reverse osmosis. When occurring at the surface of an osmotic membrane, it causes the effective osmotic pressure to be greater than the osmotic pressure of bulk brine, and the operating total pressure must be increased by this increment to maintain the desired water withdrawal flux. The importance of salt build-up can be estimated using the existing theories of diffusion and mass transfer. Such estimates for turbulent and laminar flow of brine past the surface of an osmotic membrane are presented. An analysis of these suggests that the salt build-up phenomena can be a serious obstacle to the development of reverse osmosis desalination processes. An analysis for constant water flux in the case of flow in a two-dimensional duct develops the relations expressing the salt concentration as a function of membrane spacing, duct length, and brine flow velocity for all positions in the channel. Numerical examples show that salt build-up may not be serious for high brine velocities with modest water removal rates. However, salt build-up at the surface of reverse osmosis membranes is serious even with the modest water fluxes attainable with present-day membranes. With the development of better membranes which permit greater water production rates, the salt build-up phenomena will become increasingly important. (Davison-IPA)
W79-06275

RESEARCH AND DEVELOPMENT OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TECHNIQUES AND EQUIPMENTS.
Badger Co., Inc., Cambridge, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 387, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 12, November 1956. 84 p, 33 fig, 7 tab. 14-01-001-65.

Descriptors: *Desalination, *Desalination apparatus, *Desalination processes, *Destillation, *Evaporation, Heat transfer, Design criteria, Laboratory tests, Sea water, Water treatment, Separation techniques, Water purification.

The development and operation of the vapor-compression distillation apparatus for saline water, Number 3 and Number 4 machines, are discussed. These machines are based on the principle of high-velocity flow of thin films of water over the heating surfaces at temperatures below the limit of scale forming. Machine Number 3 was constructed with 18 inch rotors. Heat transfer efficiency was demonstrated on sea water in a test run of over 300 consecutive hours. Machine Number 4 using five foot diameter disks was constructed and operated on sea water and tap water to extend and confirm the information obtained on the smaller machines and to explore the effect of increasing size on the practicability and efficiency of centrifugal evaporator recompression stills. Data from the tests of both machines is presented in tabular form. Engineering designs for a 25,000 gpd unit were developed based on the investigations of the Number 3 and Number 4 machines. Sketches of the design and a description of the process are presented. The investigations demonstrated that heat transfer rates five to seven times as high as those of sea water evaporators can be maintained. This type of thermocompression equipment has the potential to distill water with about one half the fuel requirement of conventional vapor-compression equipment. (Davison-IPA)
W79-06276

NEW AGENTS FOR USE IN THE HYDRATE PROCESS FOR DEMINERALIZING SEA WATER,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
F. A. Briggs, Y. C. Hu, and A. J. Barduhn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 143, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 59, March 1962. 44 p, 8 fig, 15 tab, 23 ref, 1 append. 14-01-001-177.

Descriptors: *Desalination processes, *Hydrate processes, Hydrates, Hydration, Crystals, Crystal growth, Equilibrium, Aqueous solution, Saline water, Heat exchangers, Separation techniques, Water treatment, Water purification, Temperature, Thermal properties, Energy.

The results of research conducted on the properties of gas hydrates from July 1960 to June 30, 1961 are reported. The process of screening compounds as possible hydrate formers has been completed, and phase relations for methyl bromide, F-21, F-31, and F-142b were determined in the presence of pure water and aqueous NaCl solutions with concentrations up to 10% NaCl. The following information was calculated for each hydrate: heat of formation, composition of the solid hydrate, and the depression of the formation temperature due to NaCl and sea salts. Calculations of energy and heat exchanger requirements for the hydrate process with six different hydrating agents are summarized. The heats of formation of methyl bromide, F-21, and F-31 were revised. The relative merits of various hydrating agents are discussed. The most economical agent for use in the hydrate process has not yet been selected. (Davison-IPA)
W79-06277

DEVELOPMENT OF AN IMPROVED SOLAR STILL,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
W. N. Grune, R. A. Collins, R. B. Hughes, and T. L. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 144, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 60, March 1962. 127 p, 44 fig, 5 tab, 23 ref, 2 append. 14-01-001-178.

Descriptors: *Desalination, *Desalination processes, *Solar distillation, *Desalination apparatus, *Solar stills, Solar radiation, Design criteria, Efficiencies, Coolants, Equipment, Separation techniques, Water treatment, Water purification, Water yield, Treatment, Condensation, Evaporation.

Nine major still designs were studied in an effort to increase the fresh water yield from solar distillers. Natural convection designs, used as controls, also provided information regarding the transfer of vapor between the brine surface and cover. It was observed that the resistance to mass transfer increased with the difference in temperature between the brine and cover raised to the two-thirds power. The overall performance of the designs suffered when multiple glazings were used to increase the operating temperatures, because the increased reflection and insulation losses offset the increase in internal operating efficiency. In the forced convection design, air is blown through the still between the brine and cover into an external water cooled condenser. The deep basin design, equipped with a brine dispersion tray to increase the mass transfer area, was the most efficient of those investigated. It exhibited an optimum air flow rate of 6 cfm and operated at 50 to 60% efficiency. Because of high reflux losses and the reflection of solar radiation by droplets of condensate on nonwettable covers, shallow basin units without brine dispersion were less successful. Experimentation with recirculating the condenser coolant to increase production indicated that the increase was insufficient to justify the additional equipment involved. The most effective design studied was a multiple-depth forced convection unit which produced over two gallons/sq yd. (Davison-IPA)
W79-06278

INVESTIGATION AND PREPARATION OF POLYMER FILMS FOR SALINE WATER CONVERSION,
Monsanto Research Corp., Everett, MA. Boston Labs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 297, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 61, April 1962. 56 p, 18 fig, 11 tab, 6 ref, 3 append. 14-01-001-203.

Descriptors: *Desalination, *Membranes, *Membrane processes, *Reverse osmosis, Mass transfer, Permeability, Desalination apparatus, Porosity, Physical properties, Chemical properties, Separation techniques, Water treatment, Water purification, Saline water, Cellulose acetate.

In an evaluation of currently (1960-61) available film formers for use in the desalination of sea water the effects of glycol additives on cellulose acetate I and II were studied. Casting techniques and pre- and post-conditioning methods were examined, and the suitable films were tested in a permeation assembly at varying temperatures under varying conditions of water separation. The experimental measurements were used to calculate the permeation coefficient, the efficiency of desalination, and the solubility coefficient. Of the other polymers tested as desalination membranes only polyvinyl alcohol showed potential. The other films were too brittle and ruptured when pressure was applied.

Two theories of the mechanism of water transmission were considered to explain the desalination of sea wate by the reverse osmosis process. The micropore theory states that water transmission through a polymeric film occurs by the passage of water molecules through the pores in the film which are too small to permit the passage of salt. In the second theory permeation takes place in three independent steps: (1) solution of the permeating molecules in the upstream face of the film; (2) diffusion of permeant molecules through the film matrix; and (3) evaporation of the permeant from the downstream face of the film. The successful use of low molecular weight hydrophilic materials as polymeric film modifiers supports the hydrogen bonding theory of transmission through the film. (Davison-IPA)
W79-06279

SEAWATER SOFTENING BY ION EXCHANGE AS A SALINE WATER CONVERSION PRE-TREATMENT,
Dow Chemical U. S. A., Freeport, TX. Texas Div.
W. F. McIlhenny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 298, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 62, May 1962. 141 p, 49 fig, 30 tab, 19 ref, 4 append. 14-01-001-205.

Descriptors: *Desalination, *Pre-treatment(Water), *Water softening, *Cation exchange, *Resins, Water chemistry, Costs, Capital costs, Sea water, Evaporation, Alkalinity, Scaling, Equilibrium, Water treatment, Water purification, Separation techniques, Calcium compounds, Magnesium compounds.

The partial softening of sea water for use as a feed for desalination plants is discussed. The incoming sea water was softened by fluidized flow with a cation exchange resin, and the concentrated evaporation blowdown liquor was used as the sole regenerant for the ion exchange resin. Data on the method of softening, cycle times and flows, and softening efficiencies obtained are reported. Variable effects on softening efficiencies were studied. A large scale cost estimate based on pilot plant data is given. Four phases of evaporator operation were studied: (1) no sea water softening or alkalinity control; (2) soft sea water and no alkalinity control; (3) soft sea water with alkalinity control; and (4) a softened groundwater from Roswell, New Mexico. For each phase evaporator scaling rate, diesel usage, and distillate production were determined; scales were analyzed. The physical characteristics of the ion exchange resins as affected by plant operation were studied. Equilibrium data for the sea water-resin system are provided with a method for calculating the ternary ion system. It is concluded that sea water is sufficiently softened by cation exchange, preventing CaSO4 precipitation when the soft sea water is evaporated to four times normal sea water; the total concentration of the raw sea water had the most significant effect on the ability of the cation exchange resin to remove calcium. Capital costs for a 10,000,000 gpd plant producing a brine concentration of four times normal sea water are 1961 $1,610,000, with sea water softening costs at $.094/1000 gallons. (Davison-IPA)
W79-06280

ANNUAL REPORT (FY 1969), ROSWELL TEST FACILITY ROSWELL, NEW MEXICO,
Westinghouse Electric Corp., Orange, CA. Water Province Dept.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 014, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 529, February 1969. 101 p, 21 fig, 22 tab, 1 append. 14-01-0001-1808.

Descriptors: *Desalination, *Desalination plants, *Roswell Test Facility, Vapor compression distillation, Evaporation, Scaling, Descaling, Calcium compounds, Brackish water, Water treatment, Water purification, Separation techniques, Research and development, Roswell(New Mexico).

The double-effect forced-circulation evaporator plant at Roswell, New Mexico, has been expanded to include an evaporator as an auxiliary test unit, membrane pilot plants, a pilot scale feed water treatment system, and a laboratory. During the past year the operation policy was changed from a demonstration plant to a development and test facility. The seed slurry method was modified and was successful in demonstrating the prevention of scale formation. The test bed plant equipment was 'moth balled' until a study was completed to determine the feasibility of repairing the compressor or replacing it with the High Temperature Water Jet Compressor. The three phases of the Auxiliary Test Unit (ATU) calcium solubility investigations are discussed, and a schematic of this system is provided in the appendix. A silica removal system manufactured by the Johns-Manville Corporation and installed in the ATU system was successfully operated in two 100-hour evaluation runs. Replacement of its exchange media was necessary due to calcium carbonate and calcium sulfate fouling which occurred during operation on raw brackish feed water. When the feed was presoftened brackish water silica removal was 100%. Lay-up of the large plant which began in July 1968 was completed before March 1969. (Davison - IPA)
W79-06281

FINAL REPORT ON FOAM FRACTIONATION OF INORGANIC SOLUTIONS,
Horizons, Inc., Cleveland, OH.
J. J. Bikerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 922, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 510, January 1970. 54 p, 4 fig, 65 tab. 14-01-0001-2118.

Descriptors: *Desalination, *Pre-treatment(Water), *Calcium, *Iron, *Manganese, *Brackish water, *Foam fractionation, Aqueous solutions, Foam separation, Metals, Surfactants, Treatment, Water purification, Water treatment, Desalination processes, Laboratory equipment, Sulfates, Water quality, Water quality control.

An investigation was undertaken to develop a method of pre-treating brackish water to facilitate the main desalination step involved in membrane processes. Calcium, iron and manganese were partially removed from the aqueous solutions of their salts by adding a foaming agent to the solution and bubbling air through it. The resulting foam contained a higher concentration of the metal than the initial residue or the residual solution. Greater concentrations of iron and manganese were found than for calcium in comparable conditions. The long-chain sulfates and poly (oxyethylene) sulfates showed the most potential of the many commercial foaming agents tested. The non-ionic surfactants were unsatisfactory. It was found that the accumulation ratio, i.e., the ratio of metal concentration in the foam to that in the initial solution, generally increases when the drainage time of the foam and the weight ratio 'surfactant:metal' increase. The accumulation ratio for the surfactant increases with the duration of drainage. The experimental results for the removal of calcium, iron and manganese are tabulated. (Davison - IPA)
W79-06282

KINETICS OF ICE NUCLEATION FROM WATER AND ELECTROLYTE SOLUTIONS,
Case Western Reserve Univ., Cleveland, OH.
G. R. Wood, and A. G. Walton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 913, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 500, November 1969. 180 p, 25 fig, 9 tab, 90 ref, 4 append.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Electrolytes, Aqueous solutions, Ice-water interfaces, Nucleation, Drops, Crystal growth, Kinetics, Energy, Physical properties, Oil-water interfaces, Environmental influences, Water treatment, Water purification, Separation techniques.

The homogeneous nucleation of ice was experimentally characterized and the applicability of nucleation theory was tested. Nucleation rates for the formation of ice from electrolyte solutions and water were calculated from observations of the frequency with which liquid droplets solidify. The stochastic nature of droplet freezings was considered and statistical methods were used for weighing observations and predicting experimental errors. Methods were found for incorporating the solidification dependencies in the rate calculations. The environmental influence on the water droplets, tested by varying the emulsion oils, droplet substrates and water purity, were found to be ineffective. Isothermal and continuous cooling experiments yielded nucleation rates which were in good agreement with each other; their temperature dependence was in accord with the functional relationship predicted by theory. The rate's temperature dependence indicated a transition to a homogeneous nucleation mechanism. Decreasing water activity and an increasing ice-solution interfacial energy were related to the increase in the isokinetic supercoolings for sodium chloride solutions. The surface energies and their temperature dependence indicate that the presence of an electrolyte disrupts the orientation of water molecules at the ice surface. It was not possible to differentiate the dependence of this effect on the specific nature of alkali halide electrolytes from experimental uncertainties. (Davison-IPA)
W79-06283

SECONDARY NUCLEATION OF ICE IN A SUSPENSION OF CRYSTALS IN TURBULENT CYLINDRICAL COUETTE FLOW,
Clarkson Coll. of Technology, Potsdam, NY.
J. Estrin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 907, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 494, January 1970. 77 p, 22 fig, 6 tab, 54 ref, 3 append. 14-01-0001-971

Descriptors: *Desalination, *Freezing, *Desalination apparatus, *Couette flow apparatus, *Nucleation, *Ice-brine systems, Boundaries(Surface), Crystallization, Crystal growth, Separation techniques, Water treatment, Saline water, Water purification, Water quality.

The use of a cylindrical Couette flow apparatus in an experimental investigation into the secondary nucleation characteristics of ice-brine slurries is discussed. This apparatus was selected because of its agitation characteristics and its large heat transfer surface to active volume ratio; it consists of two, vertical, concentric cylinders with the slurry of crystals contained in the annulus between them. The unit was employed with the ice-brine system to generate ice crystals with continuous and batch methods of operation. Stable deposition of ice upon the cooling surfaces, the major operational problem, was more severe in continuous operation experiments than in batch experiments. The combination of continuous and batch crystallization experiments is suggested as potentially providing the most meaningful results in the secondary nucleation process. The level of agitation appears to be an important variable determining nucleation kinetics. It is concluded that the Couette flow apparatus is a useful means for investigating the secondary nucleation characteristics of ice-brine slurries. (Davison-IPA)
W79-06284

DIFFUSION IN TERNARY AQUEOUS SALINE SOLUTIONS,
Loyola Univ., New Orleans, LA.
R. P. Wendt, and M. Shamim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 917, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report

No. 504, December 1969. 72 p, 7 fig, 16 tab, 31 ref, 5 append. 14-01-0001-1303.

Descriptors: *Aqueous solutions, *Saline solutions, *Diffusion, *Saline water systems, *Electrolytes, Ions, Magnesium compounds, Sodium compounds, Sea water, Computer programs, Laboratory equipment, Desalination, Water analysis, Water chemistry.

An investigation of the electrolytic ternary system H20-MgC12-NaCl, containing divalent ions, was undertaken to help technologists working with systems similar to sea water. Various diffusion theories in ternary systems and theories for predicting diffusion coefficients are discussed. The experimental and theoretical procedures described include: preparation of solutions, cell calibration, and methodology. Physical methods of solution analysis were selected. It was found that to obtain maximum accuracy in determining some coefficients the solutions should be analyzed chemically or physically for each solute; this would involve a great number of lengthy analyses. The rotating diaphragm diffusion cell developed for the experimental work required no maintenance or recalibration. The solution concentrate it uses must be slightly greater than C=0.05M to avoid solute-porous glass disc interactions. This cell cannot be used with nonaqueous systems. In this study the large cross-term coefficients D12 and D21 measured for each of the H20-MgC12-NaCl systems indicated that errors may be introduced by assuming electrolyte solutes in multicomponent systems diffuse independently according to Fick's law. Computer printouts of the programs for calculating diffusion coefficients and activity coefficient derivatives are provided in the appendices. (Davison-IPA)
W79-06285

FEASIBILITY, RESEARCH AND ANALYSIS OF HEAT EXCHANGE SYSTEMS WITHOUT HEAT EXCHANGE SURFACES: LABORATORY STUDY OF SINGLE STAGE VAPOR REHEAT DISTILLATION,

FMC Corporation, Santa Clara, CA. FMC Machinery/Systems Group.
W. S. Thompson, T. Woodward, W. A. Shrode, E. D. Baird, and D. A. Oliver.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 299, Price codes: A13 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 63, April 1962. 272 p, 41 fig, 25 tab, 28 ref, 2 append. 14-01-001-163, -173-217.

Descriptors: *Desalination, Desalination apparatus, *Heat exchangers, *Distillation, Heat transfer, Organic compounds, Solubility, Drops(Fluid), Particle size, Flash distillation, Separation techniques, Water treatment, Water purification, Sea water.

The research is presented in two parts. In Phase One of Part A, the literature was reviewed with regard to free rise or fall of liquid drops in water, flooding velocities in spray columns, and heat transfer coefficients in spray columns. Of the three potential heat exchange liquids studied and tested, hydrocarbons of high molecular weight appeared most suitable as heat-exchange media. Calculations were made to determine the approximate size of equipment required for a 10,000,000 gpd sea water distillation plant. In Phase Two of Part A certain properties of hydrocarbons were discussed regarding shell fluids. Each of the following specific subject areas are treated independently: (1) the solubility of hydrocarbons in water and the solubility of water in hydrocarbons; (2) the effect of variable specific heat on the performance of a heat exchanger; and (3) the rate of rise of hydrocarbon drops in water and the effect of drop size on the dimensions of the heat exchanger. In Part B the construction and operation of experimental heat exchangers is discussed. The data obtained indicates that heat transfer is approximately a linear function of oil fluidity for top hot operation. Other variables affecting heat transfer include flow rate and direction of heat flow. It was found that heat transfer is practically independent of orifice diameter. (Davison-IPA)
W79-06286

DETERMINATION OF THE PRACTICALITY OF THE OSMIONIC PROCESS,

Southern Research Inst., Birmingham, AL.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 345, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 64, August 1962. 96 p, 25 fig, 11 tab, 4 append. 14-01-001-193.

Descriptors: *Desalination, *Desalination processes, *Osmionic process, *Demineralization, *Economic feasibility, *Project feasibility, Resistance, Membrane processes, Separation techniques, Water treatment, Water purity, Water purification, Costs, Estimated costs, Laboratory tests, Laboratory equipment.

An eight cell bench-scale osmionic demineralizer was developed in which the demineralization performance closely approached theoretical predictions. The final design, evaluated experimentally in short term runs, gave trouble-free operation during two weeks of intermittant operation. It is believed that changes in the physical design would not effect major improvements in demineralization performance. Experimental work validated the corrected theoretical expressions describing demineralization performance. It was found that the usual methods for measuring membrane resistance gave values that may not be representative of the actual resistance occurring during demineralization. A study was made to determine which methods of measuring resistance and transference in membranes would give values representing their actual occurrence during demineralization. Cost estimates show that demineralization by the osmionic process would be two to three times as much demineralization by electro-dialysis. (Davison-IPA)
W79-06287

INVESTIGATION OF THE USE OF ACOUSTIC VIBRATIONS TO IMPROVE HEAT TRANSFER RATES AND REDUCE SCALING IN DISTILLATION UNITS USED FOR SALINE WATER CONVERSION.

Southwest Research Inst., San Antonio, TX.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 346, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 65, August 1962. 158 p, 43 fig, 29 tab, 8 ref. 14-01-001-188.

Descriptors: *Desalination, *Heat transfer, *Boiling, *Vibrations, *Acoustics, *Reynolds number, Flow, Water analysis, Separation techniques, Water treatment, Desalination apparatus, Condensation, Steam, Resonance, Standing waves.

A boiling heat transfer study was undertaken to define the magnitude of heat transfer improvement and the limits of heat flux over which vibration of the heat transfer surface might improve nucleate boiling coefficients. The effect of vibration on heat transfer from the inner tube to water in forced axial flow through an annulus was investigated at Reynolds numbers of 5,000 to 28,000. Increased heat transfer rates were produced by transverse vibration of the inner tube, and improvement with annulus ratios was greater at low flow Reynolds numbers. However, the economic advantage increased with increasing Reynolds numbers. The use of resonant acoustic vibrations in water was studied. Considerably less improvement in forced convection heat transfer was produced than for vibration of the heat transfer surface. Increases in steam condensation rates up to 122% were observed in the study of the effect of vibration of the heat transfer surface on steam condensation. Vibration on nucleate boiling transfer was investigated over heat flux ranges of 2,300-15,200 and 50,000-250,000 Btu/hr-sq ft. Boiling heat transfer coefficients increased as high as 133% at a heat flux of 4,000 Btu/hr-sq ft with inner tube variation at its resonant frequency of 38 cps and an amplitude of 0.35 sec. It is concluded that the use of vibration of the heat transfer surface to improve heat transfer in desalination has potential economic advantage (Davison-IPA)
W79-06288

DIFFUSION STILL ANALYSIS,

General Electric Co., Burlington, VT. Advanced Science and Technology Lab.
P. Kroeger.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 672 Price codes: A13 in paper copy, A01 in microfiche OSW Research and Development Progress Report No 99, April 1964. 283 p, 93 fig, 55 tab, 25 ref. 14-01-0001-314.

Descriptors: *Desalination, *Desalination apparatus *Diffusion still, Evaluation, Feasibility, Heat transfer, Mass transfer, Computer programs, Equations Separation techniques, Water treatment, Water purification, Laboratory tests, Laboratory equipment Saline water, Scaling, Corrosion.

Experimental and analytical work was undertaken to determine the feasibility and performance capability of the diffusion still process. Single-stage and multi-stage performance models were developed to study the heat and mass transfer mechanism and to permit performance predictions beyond the range of the available test equipment. A system of equations describing the heat and mass transfer in a single-stage unit was developed, and solved in a computer program. In comparing the computed single-stage results with test data from the literature good agreement was found for reservoir-condenser temperature differences below 35F. The multi-stage system was treated as a series of single stages. The system of equations developed for describing a multi-stage diffusion still was also solved in a computer program, and the results were in satisfactory agreement with test data from the literature. The influence of various design and process parameters for both the single- and multi-stage performances were studied. The losses occurring in the multi-stage unit during testing were inherent in the design of the unit rather than the diffusion still process itself. The main loss was by direct evaporation of incoming reservoir water and condensation of this water within the condenser. An inspection after saline water tests revealed no scale formation occurred, but the use of the combination of a copper condenser and aluminum disks resulted in some aluminum corrosion. (Davison-IPA)
W79-06289

HIGH-TEMPERATURE TRANSFERENCE NUMBERS IN PURE AND MIXED AQUEOUS ELECTROLYTES,

Southern Research Inst. Birmingham, AL.
E. B. Dismukes.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 581, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 87, March 1964. 38 p, 9 fig. 14-01-0001-254.

Descriptors: *Electrolytes, *Aqueous solutions, *Moving boundary method, Electrochemistry, Anions, Cations, Water properties, Desalination, Desalination processes, Laboratory tests, Temperature separation techniques, Water treatment, Water purification.

A research program was undertaken to obtain fundamental information on the properties of aqueous electrolytes by measuring and interpreting transference number data under conditions where a paucity of data exists. Electrolytes containing sodium and magnesium cations and chloride and sulfate anions were studied. Transference measurements were made with the moving boundary method, and an electrometric technique was used to determine displacement rates. The results of the procedures were unsatisfactory in reproducibility. The range in results from duplicate experiments frequently differed from the desired accuracy of approximately 0.05% by 0.2% or more. The precision of data obtained from experiments with transference in NaCl solutions showed the effect of temperature variations at temperatures up to 125C. In other experiments the precision was unaccepta-

ble. It is thought that variations in the diffuseness of the moving boundary may be responsible for the poor reproducibility in transference data. (Davison-IPA)
W79-06290

SECOND ANNUAL REPORT, SALINE WATER DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS,
Stearns-Roger Corp., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 681, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 100, March 1964. 92 p. 20 fig, 5 tab. 14-01-001-218.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Long-tube vertical multiple effect evaporation, Demonstration Plant No. 1, Freeport(Texas), Equipment, Materials, Analysis, Sea water, Water treatment, Water purification, Separation techniques, Evaporation, Scaling, Water yield, Research and development, Water costs.

Technical, economic, and logistical evaluations of the Long-Tube Vertical (LTV) multiple evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, are reported for the period July 1, 1962 to June 30, 1963. Results of a microbiological survey indicated no corrosion and only very minor problems in other areas. An intensive deaerator performance investigation shows that 2000 lbs/hr of steam are required for maximum carbon dioxide and oxygen removal. The maximum production of the plant was determined to be 1,200,000 gpd. The factors limiting the equipment at this capacity were P-17 brine pump and maximum temperature (without scaling) to the first effect evaporator. No definite conclusions have been formulated from data compiled to determine the operating efficiency of the heat exchangers and the evaporators. Despite a 93 and one-half day shut down for maintenance total annual production and cost figures compare favorably with those of the previous year. Total production for the period was 250,183,830 gallons, and average total unit gross cost/1000 gallons was $1.68. The major technical facets, process, equipment, and materials analyses were evaluated based upon the experimental and operational data compiled during the period. (Davison-IPA)
W79-06291

RESEARCH AND DEVELOPMENT ON REVERSE OSMOSIS MEMBRANE MODULES,
General Atomic Co., San Diego, CA.
V. Merten.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 204, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 165, January 1966. 62 p, 21 fig, 6 tab, 2 append. 14-01-0001-426.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, Membranes, Materials testing, Fabrication, Operations, Strength of materials, Compressive strength, Plastics, Separation techniques, Water treatment, Water purification.

Work on the spiral-wound reverse osmosis membrane module is reported from the time of its conception to July 1, 1965. Emphasis during the past year was (1) on finding suitable product water side backing materials which would support the membrane and at the same time allow the product water to be removed, and (2) on the fabrication method of the modules. Compression strength requirements and pressure drop were considered in selecting the product water side and brine side spacer design. The most promising materials selected include plastic materials for the brine side spacer in all systems and for the product water side space in low-pressure systems; and or glass bead materials were selected for the product water side spacer in high pressure systems. Two types of modules are being fabricated. The first type utilizing plastic backing material suitable for long-term use at pressures up to 200 psi, has been tested extensively and is considered reliable for use in commercial systems. The second type utilizes glass beads as the backing material and is suitable for system pressures of 1500 psi and above. The modules performed well as complete units at pressures up to 400 psi. Module performance test data are presented and the test loop is described. (Davison-IPA)
W79-06292

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
For primary bibliographic entry see Field 5D.
W79-06340

THE INFLUENCING OF HIGH MOLECULAR WEIGHT ADDITIVES ON THE FLASHING PROCESS (A SCREENING STUDY),
Houston Research Inc., TX.
A. E. Dukler, and R. F. Castle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 926, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 515, April 1967. 25 p, 10 fig, 1 tab. 14-01-0001-530.

Descriptors: *Desalination, *Desalination processes, *Multi-stage flash distillation, *Additives, *Polymers, Organic compounds, Plastics, Chemicals, Drag, Resistance, Weight, Equipment, Laboratory tests, Mass transfer, Equilibrium, Separation techniques, Water treatment, Water purification.

Three high molecular weight polyethylene oxide polymers were mixed with distilled water to form an additive solution in an evaluation of their significance in drag reduction in flash systems. The experimental equipment consisted of a Plexiglas single stage flash chamber with a liquid holding chamber, rectangular underflow orifice, a flash liquid splash plate, and a liquid baffle; other equipment consisted of a steam jet vacuum system, reservoir and pump. During the 14 test runs the additive rate was measured by volume change in the feed tank. The test runs were made with different additives at different rates, and with different conditions of vacuum, temperature, and flashing of liquid. Although the amount of drag reduction was not significant with these additives, they did cause more uniform bubble distribution downstream of the orifice. This is expected to cause improved mass transfer in the flash chamber, more rapid approach to equilibrium, and shorter metastable periods. (Davison-IPA)
W79-06424

STUDY AND FIELD EVALUATION OF SOLAR SEA-WATER STILLS,
Battelle Memorial Inst., Columbus, OH.
J. W. Bloemer, R. A. Collins, and J. A. Eibling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 934, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 50, September 1961. 123 p, 101 fig, 7 tab, 2 ref, 4 append. 14-01-001-108.

Descriptors: *Desalination, *Solar distillation, *Distillation, *Evaporation, *Solar stills, Equipment, Desalination apparatus, Research and development, Solar radiation, Plastics, Water yield, Heat loss, Design criteria, Construction costs, Energy balance, Solar distillation research station, Florida, Water treatment, Separation techniques.

Research conducted from January 20, 1958 to January 31, 1960 on direct solar distillation is reported. In this process saline water is evaporated from a basin or wick through solar radiation, and the vapor is condensed on some lower temperature surface of the still. A solar distillation research station was established in Northern Florida, where three basin-type solar stills were constructed and evaluated. Life tests of various plastic films were started during the research period. The research station and the stills are described. Performance data obtained during still operation is presented in detail. Results of these performance tests show that the productivity of the basin-type stills was nearly entirely dependent upon the intensity of the solar radiation, and it was not affected appreciably by weather conditions. Two Du Pont air-supported plastic stills of 500 and 2300 sq ft were also constructed; they were operated for about a year. It was found that there was very little difference in the performance of either type of still when both were in good operating condition. The greatest single heat loss in the basin still is radiation from the basin water to the cover. An improved design for the deep-basin still using an asphalt base, concrete support beams and a glass cover would reduce construction costs and increase its life. (Davison-IPA)
W79-06426

EXPANDED GLASSY POLYMERS AND POLYELECTROLYTE COMPLEXES AS REVERSE OSMOSIS AND ION-SELECTIVE MEMBRANES,
Massachusetts Inst., of Tech., Cambridge.
R. F. Baddour, W. R. Vieth, A. S. Douglas, and A. S. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-191 232, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 274, October 1967. 81 p, 30 fig, 4 tab, 27 ref, 2 append.

Descriptors: *Desalination, *Membranes, *Fabrication, *Materials, *Polymers, *Evaluation, *Materials testing, *Plastics, Reverse osmosis, Thin films, Technology, Permeability, Desalination apparatus, Electrolytes.

The development of methods for synthesizing new hydrophilic membrane materials such as, polyelectrolyte complexes, polyurethanes, and hydroxyethyl methacrylate (HEMA) membrane systems is discussed. The research goal was to develop new materials with higher water permeabilities and longer useable lifetimes than cellulose acetate (CA), while keeping the salt rejection capacities of CA. In an effort to improve the performance of cellulose nitrate and other existing membranes modifications were made in the template inclusion technique with and without selective post-annealing. The experimental procedure involved the preparation and evaluation of hyperfiltration systems; characterization techniques are discussed. Experimental results show that the permeability of a film to dissolved salts can be controlled by varying the membrane preparation conditions. Reduction of the salt permeability usually coincides with reduction of water flux through the membrane. Cellulose nitrate and HEMA showed salt rejections of 90% at low rates, with polyurethanes having only a slightly lower value. New techniques were developed to control the water flux and salt rejections for these three materials; technology to control the properties of a number of hydrophilic polymers is now available. Polyurethanes and HEMA, prepared as ultrathin films, are the most promising materials for use in reverse osmosis. (Davison-IPA)
W79-06427

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN NEW MEXICO,
Southwest Research Inst., San Antonio, TX.
D. E. Morris, and W. L. Prehn, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-208 787, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 767, Int-OSW-RDPR-71-767, September 1971. 174 p, 29 fig, 100 tab, 79 ref, 7 append. 14-01-0001-2580.

Descriptors: *Desalination, *Desalination processes, *Water supply, *Water treatment, *Cities, *Feasibility, *Economics, *Desalination plants,

Distillation, Electrodialysis, Flash distillation, Freezing, Reverse osmosis, Vapor compression distillation, Longtube vertical distillation, Water quality, Water quality control, Desalination wastes, New Mexico.

In a statewide study of the technical and economic feasibility of desalting the five New Mexico communities, Artesia, Gallup, Moriarity, Tularosa, and Zuni Pueblo, were selected on the basis of deteriorating water quality in their present water supplies. All local conditions, topography, climate, water demand, sewage production, and existing plant, were considered in determining whether or not desalting could improve water quality under acceptable economic conditions. The various desalting processes were calculated with regard to the individual community characteristics, and the most applicable process was selected for each. Calculations were made for electrodialysis, reverse osmosis, vapor compression-vertical tube evaporator-multistage flash distillation, vacuum-freezing vapor compression, and ion exchange in several combinations. Complete system costs are reported on the basis of product water which includes feedwater production, the plant and appropriate pretreatment, brine disposal, and pipelines. The final product water quality parameters include: 500 ppm TDS maximum; 250 ppm sulfates maximum; and 100 ppm CaCO3 hardness maximum. It was assumed that part of the brine from the desalt plant would be mixed with the effluent discharged from existing sewage treatment plants. All criteria were used only for developing the costs which are presented. (Davison-IPA)
W79-06428

NEW AND IMPROVED METHODS FOR LOWER COST SOLAR DISTILLATION,
New York Univ., NY. Coll. of Engineering.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 402, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 31, August 1959. 40 p, 12 fig, 3 ref. 14-01-001-68.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Solar stills, Design criteria, Equipment, Construction materials, Feeding rates, Flow, Flow rates, Condensation, Distillation, Heat exchangers, Heat flow, Solar radiation, Solar distillation, Separation techniques, Water treatment, Water purification.

Continued work in the design of and experimentation with flat, tilted single effect and multiple effect solar stills is reported. Improvements in single effect solar stills were obtained by using the heat carried away in the overflow brine and regulating the flow rate of the feed water. Attempts to reuse the heat of condensation failed to increase the distillate yield. A 10 to 15% increase in water yield on sunny days resulted from the use of a heat exchanger tube to recover the heat carried away by the outflowing brine; larger increases occurred on cloudy or partly cloudy days. The use of solar radiation to operate a capillary flow rate governor led to automatic regulation at the feed water. It was found that an increase in temperature changes the fluidity of the feed water, and thus the feeding rate increases in proportion to solar radiation intensity. Electrical heating was used during the sunless colder months in tests of new large multiple effect stills. The results obtained with the use of aluminum sheets were comparable to those previously obtained with Mylar films. This new still was constructed with 7.9 sq ft evaporating plates. The construction and materials of construction for both types of stills are discussed, and diagrams of the stills are provided. (Davison-IPA)
W79-06429

AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DEMINERALIZATION OF SALINE WATER,
Battelle Memorial Inst., Columbus, OH.
J. C. Bell, R. C. Crooks, W. T. Holser, G. F. Sachsel, and J. R. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 400, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 27, July 1959. 62 p, 5 fig, 17 tab, 51 ref, 5 append. 14-01-001-89.

Descriptors: *Desalination, *Geothermal studies, *Demineralization, *Estimated costs, Engineers estimates, Thermal conductivity, Thermal properties, Heat flow, Thermodynamics, Equilibrium, Electric power production, Evaporation, Separation techniques, Water treatment, Water purification, Saline water.

A literature survey, a theoretical analysis of heat flow into different hole configurations in the earth, and an engineering appraisal of the utilization of geothermal energy were used to evaluate the potential use of geothermal energy for the demineralization of saline water. The selected 'best' determinations of equilibrium heat flow in various regions, estimates of equilibrium heat flow, temperature gradients, and thermal conductivities of rocks, all determined from the literature, are tabulated. The geological factors contributing to increased heat flow in the earth include recent igneous activity, regional increases in radioactivity of the earth's crust, presence of mountain roots, and simultaneous uplift and erosion. Four basic hole configurations were studied: (1) a plane, (2) a sphere, (3) a horizontal hole, and (4) a vertical hole. The literature provided mathematical solutions for the first three, and an original solution for the vertical hole was derived in this study. A water loop which conveyed heat from the source to an expansion turbine for electric power generation or a multiple-effect evaporator comprised the system considered. Cost estimates for a salt water evaporation plant using geothermal energy with an average thermal gradient in a 20,000 ft vertical shaft in granite, 1 ft in diameter, were over $28/1000 gallons of fresh water. The cost of the hole represented about 75% of the total estimated investment. (Davison-IPA)
W79-06430

PRODUCING PERMANENTLY HYDROPHYLIC SURFACES ON PLASTIC FILMS FOR SOLAR STILLS,
Franklin Research Center, Philadelphia, PA.
R. A. Erb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 064, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 29, September 1959. 30 p, 4 fig, 2 tab. 14-01-001-168.

Descriptors: *Solar stills, *Films, *Coatings, *Plastics, *Titanium, Testing, Evaluation, Condensation, Surfaces, Silicon, Wettability, Hydrolysis, Submergence, Research and development, Water treatment, Desalination, Desalination processes, Desalination apparatus, Separation techniques.

Two approaches were investigated in the effort to produce a permanent transplant hydrophilic surface on a variety of plastic films for solar still condensing surfaces. The first method involved the vacuum deposition of silicon monoxide on the surfaces; the second involved the chemical deposition of titanium dioxide on the surface by means of the hydrolysis of tetraalkyl orthortitanates. Both methods proved to be technically feasible, but due to its lower cost and its ready adaptability to large scale operation, titanium dioxide was the process of choice. In a study of the parameters of the titanium dioxide process with optimum alkyl titanate, solvent, relative humidity, and other variables were determined. The immersion durability of titanium dioxide coated polymers was studied, and after seven months immersion in distilled water no coating failure was apparent. A continuous dip-coating technique was performed satisfactorily on cellulose acetate 9.5 in wide and 100 ft long, and a large test was made on weatherable Mylar, 54 in wide. Cloudy areas formed because of high humidity. (Davison-IPA)
W79-06431

BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION.
Office of Water Research and Technology, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 554, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 83, October 1963. Compiled by G. F. Mangan, Jr., J. M. Shackleford, and K. A. Kase, 121 p.

Descriptors: *Bibliographies, *Publications, *Membranes, *Membrane processes, *Desalination, *Patents, Saline water, Technology, Research and development, Design, Ions, Hydration, Physicochemical properties, Desalination apparatus, Thermodynamics, Mass transfer, Ion transport, Films, Permselective membranes, Semipermeable membranes, Resins, Water purification, Separation techniques, Water treatment.

A chronological listing of published literature references on membrane technology in the desalination of saline water is presented for the years 1908 through 1963; the listings for each year appear alphabetically according to author. The patent bibliography contains patent listings for the U.S., Great Britain, Japan, Austria, Canada, The Netherlands, Germany, East Germany, France, India, Israel, Italy, Poland, Switzerland, and the U.S.S.R. (Davison-IPA)
W79-06432

CONVERSION OF SALINE WATER: A BIBLIOGRAPHY OF LITERATURE RESULTING FROM THE ACTIVITIES SPONSORED BY THE OFFICE OF SALINE WATER.
Office of Water Research and Technology, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 546, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Report No 82, October 1963. Compiled by K. A. Kase, 63 p.

Descriptors: *Saline water, *Bibliographies, *Publications, Desalination, Demineralization, Distillation, Solar distillation, Electrodialysis, Freezing, Flash distillation, Hydrate processes, Ion exchange, Ion transport, Long-tube vertical distillation, Membrane processes, Osmosis, Reverse osmsosis, Desalination apparatus, Desalination plants, Water treatment, Separation techniques, Water purification.

Monographs, scientific and technical reports, papers, and periodical articles resulting from the activities of the Office of Saline water, or written by a staff member of that Office are listed alphabetically by author. Articles and monographs are listed in Part I; Research and Development Progress Reports, in Part II. Of the eight appendices, five contain listings for papers presented at symposia, one contains a listing of papers presented at a conference, and the remaining two contain an author index and a subject index. (Davison-IPA)
W79-06433

CONCENTRATION POLARIZATION IN REVERSE OSMOSIS DESALINATION WITH VARIABLE FLUX AND INCOMPLETE SALT REJECTION,
Massachusetts Inst. of Tech., Cambridge.
P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-179 436, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 145, September 1965. 41 p, 7 fig, 4 ref, 1 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membrane processes, Equations, Computer programs, Permeability, Water treatment, Water analysis, Separation techniques, Water purification, Research and development.

The concentration polarization in a saline solution flowing in a two-dimensional channel between flat

arallel osmotic membranes is analyzed. A Fortran rogram is developed to solve the finite-difference quations derived from theoretical analysis. The ermeation flux falling off as the salt builds up at he membrane surface and the effect of incomplete alt rejection are examined. The results indicate hat comparison of these solutions with the solu- ions for a constant flux membrane operating at the ame average permeation flux show that the con- entration polarization is greater for the variable lux case near the channel entrance, and is lower ear the channel exit. A simple design procedure is ormed in which the constant flux solution can be sed to predict the effects of concentration polar- zation on the required pressure drop and on the roduct water salinity for a variable flux mem- ranes. (Davison-IPA)
W79-06434

THE MECHANISM OF DESALINATION BY REVERSE OSMOSIS,
Aerojet - General Corp., Azusa, CA.
B. Keilin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 395, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 117, 1964. 86 p, 17 fig, 22 tab, 22 ref. 14-01-0001-338.

Descriptors: *Desalination, *Desalination process- es, *Reverse osmosis, *Membrane processes, Mem- branes, Physical properties, Chemical properties, Fabrication, Mass transport, Bound water, Thin films, Plastics, Heat treatment, Moisture content, Research and development, Permeability, Perme- able membranes, Permselective membranes, Hy- dration, Ions, Additives, Separation techniques, Water treatment.

Certain aspects of the swelling of secondary cellu- ose acetate by membrane salts have been clarified n continuing research on the mechanism (s) of material transport across a reverse osmosis mem- brane. The completed membrane salt studies have yielded new data regarding various membrane fab- rication parameters. The depth of the active layer has been redetermined by gradual hydrolysis of the active layer to a non-salt-retaining cellulose struc- ture. The water contents of thin films, determined gravimetrically, prove that these films are less highly swollen than the bulk membranes. The bound water content of desalination membranes before and after heat and pressurization treatments vary in a similar manner to that of the total water content. That permeabilities of many inorganic salts vary inversely with the extent of hydration of the component ions has been interpreted in terms of the bound water requirement for solution of the various ions in the membrane. It was found that the permeabilities of many sterically similar com- pounds with different functional groups vary with the hydrogen-bonding capacities of the solute spe- cies. Salt-retention capacity of the desalination membrane was improved by the addition of small amounts of additives to the feed solution. Feed additive effectiveness appears to be related to the surfactant capacity of the solute species. After investigation it was determined that microbial de- composition was responsible for the decrease in membrane desalination properties occurring upon storage in saline solution, rather than hydrolysis due to the brine. (Davison-IPA)
W79-06435

SALT CONCENTRATION AT THE SURFACE OF TUBULAR REVERSE OSMOSIS MEMBRANES,
Massachusetts Inst. of Tech., Cambridge.
R. E. Fisher, T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 203, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 141, September 1965. 38 p, 7 fig, 3 tab, 9 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Salt build-up, *Reverse osmosis, *Membrane processes, Permselective membranes, Semipermeable membranes, Equations, Digital computers, Diffusion, Velocity, Flow, Separation techniques, Water treatment, Water purification.

In a preliminary analysis of salt build-up, the saline solution was assumed to contain a single salt with a diffusion coefficient independent of salt concentration. The system considered was assumed to be isothermal, the water flux was assumed constant over the entire surface of the cylindrical membrane, and free convection was neglected. The velocity field equations are combined with the salt diffusion equations to express the salt concentration field as a function of the tube diameter, tube length, axial saline water flow velocity and water flux through the membrane. The equations were solved in two phases with a digital computer. Phase I generated the eigenvalues; Phase II generated the radial eigenfunctions, the series constants, and the concentration field from the eigenvalues. It was found that the effect of the salt build-up on the water flux depends on the operating conditions, and to keep less than a two-fold build-up of the salt concentration at the membrane surface over the initial feed concentration, very small diameter tubes, very short channel lengths, or multiple pass operations are required at higher water fluxes. (Davison-IPA)
W79-06436

REVERSE OSMOSIS FOR WATER DESALINATION,
General Atomic Co., San Diego, CA.
H. K. Lonsdale, U. Merten, R. L. Riley, K. D. Vos, and J. C. Westmoreland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 696, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 111, May 22, 1964. 149 p, 49 fig, 17 tab, 96 ref. 14-01-0001-250.

Descriptors: *Desalination, *Desalination process- es, *Reverse osmosis, *Membranes, *Fabrication, Laboratory testing, Materials testing, Plastics, Physical properties, Estimated costs, Water costs, Desalination plants, Desalination apparatus, Separation techniques, Water treatment, Water purification, Sea water, Brackish water, Boundary layers, Mass transfer.

The properties of semipermeable membranes were studied and phenomenological descriptions were derived of flow through such membranes and the liquid phases in contact with them. Preliminary considerations of some of the engineering problems related to the reverse osmosis process, and an initial attempt at developing optimization techniques for reverse osmosis plant design are also included. Experimental work on the boundary-layer effects in reverse osmosis, transport properties of cellulose acetate (CA) membranes, polyvinyl alcohol (PVA) membranes, the transport properties of cellophane and other alternative membrane materials is discussed. Results of experimental work to determine lifetime properties of cellulose acetate membranes indicate that these membranes, as they are now prepared, can be expected to have a life of several months in brackish waters, but their useful lifetime in concentrated sea water may be shorter. The theoretical treatment of boundary-layer effects gave a reasonable representation of the experimental data obtained with CA membranes. The results of an economic study made of the energy requirements and capital costs of proposed sea water conversion systems using reverse osmosis show that 30 to 50% of the cost of product water is accounted for by capitalization charges on the membrane separator. The estimated product water cost figure of $1.00/1000 gallons indicates that the development of more efficient membranes is not a prerequisite to the establishment of reverse osmosis as a desalination process competitive with existing systems. (Davison-IPA)
W79-06437

CHAMBER GEOMETRY IN MULTI-STAGE FLASH EVAPORATORS.
Weir Westgarth Ltd., London (England).
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 682, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 108, July 1964. 91 p, 34 fig, 3 tab, 4 ref, 5 append. 14-01-0001-262.

Descriptors: *Desalination, *Desalination process- es, *Desalination apparatus, *Flash distillation, Design data, Specifications, Equations, Volume, Shape, Temperature, Separation techniques, Water treatment, Water purification, Sea water, Reynolds number.

The importance of various parameters on the length of a typical stage in a multi-stage flash evaporator for sea water conversion was studied on a simulated flash chamber with an adjustable wall. Using a set of standard conditions chamber efficiency was found at different chamber lengths, and an optimum length for complete vaporization was established. Data obtained from the examination of each parameter over a range of variables were expressed in the form of efficiency curves vs chamber length; constant efficiency curves were plotted for a given parameter. An empirical equation, derived from the test data for a specified range of conditions, enables an estimate to be made of the minimum chamber length required for complete flash-off. Of all the variables studied, the brine flow had the greatest effect on the chamber length. It is concluded that: if flash chamber length is reduced for constant flashing conditions, the chamber efficiency remains constant at 100% until a critical point is reached; further length reductions result in a rapid drop in efficiency for small decreases in length; chamber length is directly proportional to stage temperature drop; the chamber length - temperature characteristic is a function of specific volume, inversely proportional to temperature; and the geometry of the interstage brine transfer and splash plate arrangement is of great importance when designing a flash chamber. (Davison-IPA)
W79-06438

FURTHER PROPERTIES OF HYDRATES AND HYDRATING AGENTS,
Syracuse Univ. Research Inst., NY.
A. J. Barduhn, N. Klausutis, R. W. Collette, and J. R. Kass.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 583, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 88, March 1964. 75 p, 10 fig, 19 tab, 26 ref. 14-01-001-177.

Descriptors: *Desalination, *Hydrates, *Hydrate processes, *Hydration, *Solubility, *Crystal growth, *Crystallization, Laboratory equipment, Calibration, Instrumentation, Measurement, Physical properties, Chemical properties, Physicochemical properties, Freezing.

New data on the solubilities of hydrating agents in water and salt solutions, two new phase diagrams on hydrate systems, and a description of work on crystal growth rates are presented. New data and calculations for the solubility of F-31 (CH2ClF) in salt solutions, F-31 in pure water, new solubility data on F-142b, and revised solubility data for F-21 are discussed. Detailed calculations on the effects of solubility on the heats of formation and composition of three hydrates are presented. The apparatus used to obtain data for the chlorine-water and chlorine-water NaCl systems was completed and tested by determining several points on the phase diagram for F-152a (CH3CHF2) and methyl chloride. Ice crystal growth research during the period was primarily directed toward refining the apparatus and its operation. The experimental work involved various methods for growing and positioning seed crystals in flowing sub-cooled water. (Davison-IPA)
W79-06439

THE INFLUENCE OF ACOUSTICAL VIBRATIONS ON CONVECTIVE HEAT TRANSFER TO LIQUIDS,
Bolt Beranek and Newman, Inc., Cambridge, MA.
R. M. Fand.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 584, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 89, March 1964. 49 p, 9 fig. 14-01-0001-246.

Descriptors: *Desalination, *Acoustics, *Vibrations, *Equipment, *Laboratory equipment, Frequency, Heat transfer, Convection, Cavitation, Sound waves, Pumps, Heat exchangers.

Research to determine the effectiveness of acoustical vibrations as a means to increase heat transfer across a solid-liquid interface is reported. An experimental apparatus was developed in the form of a closed loop of piping through which water is pumped, and into which instrumented test specimens in the form of circular cylinders can be inserted. Controlled and measured acoustical vibrations must be created at the location where the test cyclinders are inserted. Calculations estimating the required intensity of the acoustical vibrations are presented. The function and operation of each of the 14 experimental apparatuses are discussed. Experimental heat transfer data were obtained under the following conditions: (1) natural convection without sound; (2) natural convection with sound, in the absence of and in the presence of cavitation; (3) forced convection without sound; and (4) forced convection with sound, in the absence of and in the presence of cavitation. The data show that acoustically induced cavitation significantly increases the rate of heat transfer across a solid-liquid interface, and that acoustical vibrations in the absence of cavitation do not appreciably affect the rate of heat transfer from a heated surface to a liquid for sound intensities up to 0.3 watts/sq cm. (Davison-IPA)
W79-06440

EXPANDED GLASSY POLYMERS AS REVERSE OSMOSIS MEMBRANES,
Massachusetts Inst. of Tech., Cambridge.
R. F. Baddour, W. R. Vieth, and A. S. Douglas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-189 421, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 144, September 1965. 88 p, 14 fig, 6 tab, 78 ref, 7 append. 14-01-0001-316.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Reverse osmosis, *Membranes, *Fabrication, Permselective membranes, Semipermeable membranes, Plastics, Water treatment, Separation techniques, Water purification, Research and development, Materials testing.

Completed research on water and ion flux through modified poly(ethylene glycol monomethacrylate), and research in progress on the salt inclusion method of membrane preparation and membrane preparation by solvent control are reported. An evaluation of existing theories on the mechanism of water transport in reverse osmosis membranes led to the hypothesis that the degree of cross linking and the hydroxyl group content of a polymer were of major importance in determining its semipermeability. A series of crosslinked reinforced membranes was prepared to test this hypothesis. These membranes, copolymers of ethylene glycol monomethacrylate (EGM), ethylmethacrylate (EM) and ethylene glycol dimethacrylate (EGD), were tested under high reverse osmosis pressure with a sodium chloride solution; water sorption tests were also conducted. The degree of salt rejection exhibited by these membranes rose as the membrane was more tightly crosslinked, then dropped off sharply. It is concluded that crosslinking has a great effect on water sorpition. One membrane, one mill thick, prepared by the salt inclusion method provided 97.8% salt rejection with a flux rate of 0.5 gal/sq ft-day. An increase in the water permeability is expected with films cast using non-solvents in the casting solution. The effects of composition and properties of the solvent mixture on the desalination and flow properties of these membranes are being studied. (Davison-IPA)
W79-06441

SURVEY OF MATERIALS BEHAVIOR IN MULTI-STAGE FLASH DISTILLATION PLANTS,
Little (Arthur D.), Inc., Cambridge, MA.
E. H. Newton, and J. D. Birkett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 924, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 512, December 1969. 95 p, 10 fig, 9 tab, 23 ref, 2 append. 14-01-0001-956.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Flash distillation, *Construction materials, *Evaluation, Tubes, Heat exchangers, Pumps, Structural members, Corrosion, Descaling, Repairing, Maintenance, Separation techniques, Water purification, Water purity, Water treatment.

The performance of all structural, heat transfer, and equipment materials utilized in 55 large multistage flash distillation plants is surveyed. Data on the frequency of repairs, repair techniques, causes for component failures, the effectiveness of ensuing remedial action, and details of feed water treatment are presented for the heat exchanger tubes, tube sheets and demisters, water boxes, pump casings and impellers, and flash chambers. To determine the relative corrosion resistance of tube alloys and the corrosivity of inlet waters, a corrosion measuring instrument, the Corrater, was used. Insufficient time spent at any one of the installations for thorough checking of the technique may have been responsible for the lack of correlation between the measurements obtained and the experience with the materials. The many and varied reasons for plant shut-down or decreased production included: scale removal-acid cleaning, general maintenance, intake structure maintenance, water box repair, tube plugging and replacement, temperature imbalance, imbalance in steam distribution between power plant and evaporator in dual purpose plants, and steam boiler problems in single purpose plants. The plants in the survey represented nearly every variety of large multi-stage flash distillation plants currently in operation around the world. (Davison-IPA)
W79-06442

RESEARCH AND DEVELOPMENT OF NEW POLYMER SYSTEMS FOR REVERSE OSMOSIS MEMBRANES,
Aerojet-General Corp., Azusa, CA.
C. W. Saltonstall, Jr., W. S. Higley, and R. E. Kesting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-176 354, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Deveopment Progress Report No. 167, February 1966. 43 p, 10 fig, 6 tab. 14-01-0001-435.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Reverse osmosis, *Desalination processes, *Plastics permeability, Permselective membranes, Semipermeable membranes, Mass transfer, Fabrication, Films, Chemical properties, Physical properties, Water treatment, Separation techniques, Water purification.

Polyacrylonitrile (PAN), polymethacrylonitrile, and poly (vinylene carbonate) were selected in a program for developing reverse osmosis membranes with osmotic and mechanical properties and chemical stability superior to those of cellulose acetate membranes. These polymers were synthesized, and the membranes prepared from each exhibited semipermeable properties in reverse osmosis tests. PAN, selected because of its crystallinity and the high polarity of the nitrile group, was prepared with dimethylformanide (DMF) as the casting solution and heat treated in water. The membranes had fluxes of 16.5 to 21.0 gal/sq ft-day and salt retentions of 10 to 29% at 1500 psi when tested with a 3.5% sodium solution. The application of polymethacrylonitrile to the preparation membranes was carried out because of its solubili in low-boiling solvents and its chemical similari to polyacrylonitrile. Membranes prepared from very-high-molecular-weight polymer had an ave age flux of 21.5 gfd and average salt retention 10%. The poly (vinylene carbonate) membran obtained exhibited salt retentions as high as 83% low flux rates when tested at 1500 psi with 3.5 sodium chloride solution. Decreased salt retentio resulted when preparation conditions were alter to provide high fluxes. A comparison and evalu tion of poly (vinylene carbonate) membranes wi cellulose acetate membranes showed that salt r tention expected from poly (vinylene carbonat was one-third of that achieved with cellulose ac tate at equivalent fluxes. (Davison-IPA)
W79-06443

THEORETICAL AND PRACTICAL ASPECT OF THE EVALUATION OF CANDIDATE RE VERSE OSMOSIS MEMBRANES FOR DE SALINATION,
Office of Water Research and Technology, Wash ington, DC. Polymer and Biophysics Div.
H. E. Podell.
Available from the National Technical Informatio Service, Springfield, VA 22161 as PB-184 98 Price codes: A03 in paper copy, A01 in microfich OSW Research and Development Progress Repo No 267, September 1967. 44 p, 4 fig, 8 ref, append.

Descriptors: *Desalination, *Desalination proces es, *Desalination apparatus, *Reverse osmosi *Membranes Membrane processes, Permeability Permselective membranes, Films, Equations, Labo ratory testing, Evaluation, Separation technique Water treatment, Water purification, Physica properties, Thin films.

The reverse osmosis process is theoretically de scribed with regard to the relevant transport equa tions and inherent membrane parameters that full characterize a candidate membrane's permeatio and permselectivity properties. The experimenta methodology and recommended test conditions fo determining these inherent properties and for eval uating various membranes for use in the proces are presented. (Davison-IPA)
W79-06444

REVERSE OSMOSIS FOR WATER DESALINA TION,
General Atomic Co., San Diego, CA.
H. K. Lonsdale, U. Merten, R. L. Riley, and K. D. Vos.
Available from the National Technical Informatio Service, Springfield, VA 22161 as PB-177 079 Price codes: A05 in paper copy, A01 in microfiche OSW Research and Development Progress Repor No 150, October 1965. 88 p, 37 fig, 16 tab, 43 ref 14-01-0001-250.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Reverse osmosis, *Fabrication, Laboratory testing, Plastics, Polymers, Deterioration, Mass transport, Transport depletion, Hydrolysis, Separation techniques, Water treatment, Water purification.

Research emphasizing lifetime studies of cellulose acetate membranes, and investigations of alternative membrane materials are reported. Although lifetime studies of cellulose acetate membranes show that the deterioration in salt rejection commonly observed in reverse osmosis systems can be controlled, the problems of marginal salt rejection and marginal flow rates after extended periods of use remain. Life test results performed on cellulose acetate membranes and evidence relating some of the observed time-dependent effects to hydrolysis of the acetate are presented. A study of the hydrolysis reaction is reported, and the quantitative relationship between hydrolysis and membrane deterioration rate is examined. The theoretical approach to membrane permeability emphasizes those aspects important in the preliminary evaluation of membrane materials. Results obtained from transport studies of cellulose acetate membranes

are presented. Studies crosslinking polyvinylpyrrolidone (PVP) are discussed. It was found that crosslinking with MDI was an effective method of insolubilizing PVP and obtaining membranes with desired water content. The potential new membrane materials investigated included nylon, polyvinyl butyral, cellulose acetates with higher acetyl content, cellulose butyrates, oxidized cellulose acetate, and other hydrophilic materials. Although nylon looks promising in terms of permeability and salt rejection, it looses its favorable physical properties as it becomes more hydrophilic. (Davison-IPA)
W79-06445

POLYELECTROLYTE COMPLEXES AS REVERSE OSMOSIS AND ION-SELECTIVE MEMBRANES,
Massachusetts Inst. of Tech., Cambridge.
A. S. Michaels, H. J. Bixler, R. W. Hausslein, and S. M. Fleming.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 078, Price codes: A05 in paper copy, A01 in microfiche OSW Research and Development Progress Report No 149, December 1965. 90 p, 30 fig, 3 tab, 28 ref. 14-01-0001-315.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, *Fabrication, Desalination apparatus, Polymers, Plastics, Mass transfer, Aqueous solutions, Solvents, Separation techniques, Water treatment, Water purification.

A brief discussion of research completed on polysalt complex membranes and transport mechanisms in cellulose acetate membranes is followed by a report of the detailed investigation being carried out on polysalt complex membranes. A preliminary investigation revealed that polysalt complexes are potentially superior desalination membrane materials, but the lack of very efficienct consolidation techniques is a major obstacle in their development. Results of the investigation of transport mechanisms in cellulose acetate reverse osmosis membranes indicate that the high desalination efficiency of these membranes is mostly due to the high concentration and high diffusivity of water in the polymer, and the low concentration and low diffusivity of ionic solutes. Polysalt complex membranes prepared by casting from polysalt complex-ternary water solutions, a water-miscible organic solvent, and a strong electrolyte were tested with 4% aqueous sodium chloride solutions at 1500 psi. The most successful membrane preparation procedures involved casting a 10 mil thickness of 18% polysalt in water, dioxane, HCl ternary, gelling in an oven at 50C for 25 minutes, and washing in water at room temperature. These membranes exhibit salt rejections of 50% and water fluxes of 2 gal-mil/sq ft-day. Other preparation methods such as the use of the hydrobromic acid-methyl cellusolve solvent system are being studied. Correlation of the reverse osmosis data with the water content of the membrane was made. (Davison-IPA)
W79-06446

INVENTORY OF PUBLISHED AND UNPUBLISHED DATA ON THE CHARACTERISTICS OF SALINE SURFACE AND GROUND WATERS OF SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Engineering and Mining Experiment Station.
E. H. Tullis, J. P. Gries, and J. H. Cope.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 381, Price codes: A08 in paper copy, A01 in microfiche. Final Report, June 1954. 154 p, 8 fig, 2 tab, 19 ref. 14-01-001-56.

Descriptors: *Data collections, *Saline water, *South Dakota, Surface waters, Groundwater, Watersheds(Basins), Publications, Drilling, Testing.

A compilation of data collected from literature on saline water analysis in South Dakota is presented. After a geological discussion of the groundwater of this area data on the analysis of both surface and groundwater are tabulated, and referenced with the appropriate bibliographic reference number. All analyses are sequentially numbered and locations for them are given on record sheets. An index of the analyses pertaining to the drainage basins of surface waters is included. Available information on 31 drill stem tests run on deep oil and water is tabulated. The extensive bibliography includes both published and unpublished sources. (Davison-IPA)
W79-06447

COST STUDIES OF LARGE MULTI-STAGE FLASH SALINE WATER CONVERSION PLANTS.
Bechtel Corp., San Francisco, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 254, Price codes: A17 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 116, October 1964. 279 p, 43 fig, 25 tab, 13 ref, 2 append. 14-01-0001-313.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Multi-stage flash evaporation, *Design criteria, *Estimated costs, Capital costs, Water costs, Construction, Construction materials, Concretes, Cost analysis, Heat balance, Temperature, Saline water, Separation techniques, Water treatment, Water purification.

A study was undertaken to determine the cost reductions of converting sea water to fresh water resulting from increasing the scale of operations, and using exhaust steam from a gas-fueled power generating station as a heat supply for the conversion plant. Seven specific cases of the multi-stage flash evaporation process were selected, and the entire study was based on a common set of site and design criteria. Results of a preliminary study indicate that coated concrete could be used for construction of evaporators for temperatures up to 250F. After work was under way, optimized evaporator designs and capital estimates of water conversion facilities were developed for 16 cases with the following ranges of steam costs and brine and sea water temperatures: steam costs of 5, 15, 25, and 35 cents/M lbs; brine temperatures of 250F and 300F; and sea water temperatures of 65F and 85F. A computer program was developed to solve the heat and material balances of the process scheme. Capital cost estimates were developed and tabulated so that the cost of water could be computed for each of these cases. Optimum plant configurations and the capital cost estimates are tabulated. A general description of the water plant and power plant are presented, and the discussion of specific plants includes equipment lists, data on the heat and material balances, and the opimum computer run. Drawings of the specific plants are provided. (Davison-IPA)
W79-06448

3B. Water Yield Improvement

A STATISTICIAN'S VIEW OF WEATHER MODIFICATION TECHNOLOGY (A REVIEW),
California Univ., Berkeley. Statistical Lab.
For primary bibliographic entry see Field 2B.
W79-06045

CLOUD PHYSICS AND WEATHER MODIFICATION.
For primary bibliographic entry see Field 2B.
W79-06046

GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES,
Arizona State Univ., Tempe. Dept. of Geology.
For primary bibliographic entry see Field 2A.
W79-06164

3C. Use Of Water Of Impaired Quality

WEYERHAEUSER'S RAISING SALMON -- USES MILL COOLING WATER AT HATCHERY,
P. I. Meadors.
Pulp and Paper, Vol. 42, No. 12, p 148-149, November, 1978. 1 fig, 3 illus.

Descriptors: *Cooling water, *Pulp and paper industry, *Water reuse, *Fish hatcheries, Wastes, Industrial wastes, Water pollution sources, Effluents, Oregon, Salmon, Chinook salmon, Coho salmon, Chum salmon, Fisheries, Fish, Aquatic animals.

Hot water (7,000,000 gal/day) from the cooling system at Weyerhaeuser Co.'s linerboard mill (Springfield, Oregon) is piped 2.25 miles to the $7,000,000 salmon hatchery. This water is combined with river water to maintain a temperature of 55F, thus reducing the rearing time for chinook, chum, and coho salmon from 18 to 6 months. (Swichtenburg-IPC)
W79-06118

3D. Conservation In Domestic and Municipal Use

METHOD FOR RECYCLING PAPER MILL WASTE WATER,
R. C. O'Brien.
United States Patent No. 4,115,188. Issued September 19, 1978. 7 p. 10 claims. 1 fig.

Descriptors: *Pulp wastes, *Waste water treatment, *Coagulation, *Water reuse, *Patents, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Hydrogen ion concentration, Recycling, Neutralization, Sludge, Landfills, Fuels, Waste disposal, White water(Paper machines), Sulfuric acid, Solid wastes.

A method for processing paper mill white water involves adding sulfuric acid to reduce the pH below 4, mixing thoroughly, adding calcium hydroxide to raise the pH to above 10, and separating the coagulated solids so formed. The clarified water can be recycled (after neutralizing) as a major source of water for the papermaking process; the coagulated solids can be used as landfill, as a low-grade pulp source, or as fuel. (Lynch-IPC)
W79-06115

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

3E. Conservation In Industry

SOME ASPECTS OF PROPER WATER MANAGEMENT IN PAPER MILLS (NIEKTORE ASPEKTY RACJONALNEGO KSZTALTOWANIA WODNO-MASOWYCH OBIEKTOW PAPIERNI),
Instytut Celulozowo-Papierniczy, Lodz (Poland).
A. Kowalczyk.
Przeglad Papierniczy, Vol. 34, No. 8, p 301-305, August, 1978. 7 fig, 18 ref, 1 tab.

Descriptors: *Water conservation, *Pulp and paper industry, Industrial water, Recycling, Water pollution sources, Pulp wastes, Water reuse, Closed systems, White water(Paper machines), Effluents, Capital costs, Costs, Water pollution control, Paper machines, Savealls.

Ways to reduce fresh water consumption in paper mills are discussed, including increasing the consistency of the stock supplied to the mill, reducing the amount of fresh water supplied directly to the paper machine (for showers, seal water, etc.), sepa-

rating white water from other wastes before treatment, proper selection and mounting of savealls, coordinating water circuits on the paper machine and the mill as a whole, and controlling water circuits on the machine with flow meters and consistency meters. The first step in a water management program should be reduction of fresh water consumption to 25-40 cu m/ton of paper through modernization and modification of the paper machine water circuit, including partial water recycling. Such reduction is relatively easy to achieve at low investment costs and is free of problems experienced in mills with a closed water cycle. (Stapinski-IPC)
W79-06119

CONSIDERATIONS IN PROCESS WATER REUSE IN NON-INTEGRATED PAPER MANUFACTURING,
Miami Univ., Oxford, OH.
A. M. Springer.
Paperi ja Puu, Vol. 60, No. 11, p 705-706, 709-712, 715-716, November, 1978. 7 fig, 11 ref, 3 tab.

Descriptors: *Paper mills, *Water conservation, *Water pollution control, Model studies, Pulp and paper industry, Effluents, Water pollution sources, Water reuse, Economics, Costs, Recycling, Industrial water, Suspended solids, Dissolved solids, Closed systems, Fine papers, White water(Paper machines).

A model fine-paper mill is analyzed for possible elimination of effluent discharge. Potential economic benefits from water, fiber, filler, and energy savings amount to $7.70/1000/kg (or $7.00/U.S. ton) for this model, and these savings must offset the cost of process modifications. A set of possible modifications to achieve total water recirculation is presented. Problems which may arise from water-conservation efforts include felt and wire plugging, corrosion, scale deposits, foaming, slime and odor formation, nonuniform sizing degree and paper color, and other difficulties affiliated with buildups of suspended solids and/or dissolved solids in the closed water circuit. These problems may prevent total system closure in practice. A steady-state mass balance calculation indicates a rapid acceleration of dissolved-solids accumulation in the white water at effluent levels below 12.5 cu m/1000 kg (3000 gal/ton) of paper produced. (Brown-IPC)
W79-06120

A REVIEW OF INDUSTRY EXPERIENCE WITH SELECTED INTERNAL PROCESS SOLIDS SEPARATION DEVICES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
J. E. McCourt.
NCASI Stream Improvement Technical Bulletin, No. 314, 57 p, August, 1978. 2 appendices, 73 ref, 5 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *White water(Paper machines), Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Water reuse, Separation techniques, Recycling, Industrial water, Equipment, Savealls, Filters, Screens, Water conservation.

A survey is presented of the capabilities of equipment used in white water reuse schemes, namely, pre-saveall devices, savealls (drum, disk, or flotation), and in-line strainers/filters. This review focuses on the use, role, and importance of post-saveall devices in providing white water of uniform quality, hence enhancing the possibility for continuity of operation and more extensive water reuse in the papermaking process. Reported experiences with post-saveall solids removal devices are described, namely, fine-screen fractionators (A. B. Floatwash and Celleco microsorter), sidehill screen derivatives (DSM screen), centrifugal fine screens (SWECO, CSC), and microstrainer units (North filter, Sinclair rotary filter). More detailed knowledge is needed of the capability and feed water quality. This information may be obtained in well designed field studies at existing installations by incorporating continuous flow measurements and on-line continuous suspended solids measurements at currently successful solids removal systems preceding machine showers. Such a study also lends itself to pilot trials of an array of available devices. (Swichtenberg-IPC)
W79-06123

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

3F. Conservation In Agriculture

REUSE PITS: CHEAPEST WATER ON THE FARM,
J. G. White.
Irrigation Age, Vol. 13, No. 3, p 58, 62, November-December, 1978. 2 fig.

Descriptors: Tailwater, Water conservation, Irrigation efficiency, Irrigation, Crop production, Irrigation practices, Nebraska, Agricultural runoff.

Described are the benefits of using tailwater pits as experienced by farmers in Nebraska. Pumping cost was reduced by one-fourth compared with the cost of pumping from deep wells, reduced time and labor, and reduced the amount of deep-well water use by 20%. It was estimated that the gravity irrigation efficiency was increased by almost 15%. (Skogerboe-Colorado State)
W79-06031

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 5G.
W79-06081

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SIMULATION OF STREAMFLOW OF ROCK RIVER AT LAKE KOSHKONONG, WISCONSIN, TO DETERMINE EFFECTS OF WITHDRAWAL OF POWERPLANT-COOLING WATER,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06315

EFFECTS OF MECHANICAL AGITATION ON DRYING RATE OF FINE-GRAINED DREDGED MATERIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
T. A. Haliburton, G. N. Durham, K. W. Brown, R. E. Peters, and T. B. Delaney, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044 843, Price codes: A07 in paper copy, A01 in microfiche. Technical Report D-77-10. September 1977. 121 p, 54 fig, 13 tab, 74 ref, 3 append.

Descriptors: *Dredging, *Slurries, *Dewatering, *Mixing, *Evaporation, Evaporation control, Evaporation pans, Sludge treatment, Surface drainage, Landfills, Waste disposal.

An evaluation of methods for the evaporative dewatering of fine-grained dredged material slurry compared continuous agitation at controlled sites during periods of high and low evaporative demand and periodic agitation to desiccate the crust. A theoretical analysis of the factors controlling evaporation of soil slurries was performed prior to field tests. Fine-grained dredged slurries were treated: in a small-scale controlled agitation experiment under conditions of low evaporative demand; in a large-scale controlled agitation experiment under high evaporative demand conditions; and in a six-month field demonstration of periodically mixing the surface desiccation crust and underlying highly moist dredged materials. Results of the study indicated that agitation of highly plastic clay slurries does not significantly influence the rate of evaporative water loss or slurry volume reduction compared to unagitated samples. The surface area of the shrinkage cracks provided additional evaporation which offset any decrease in the rate of evaporative drying. The standard Class A Pan Evaporation procedure can approximate the maximum rate of evaporation in highly plastic clay slurries; the duration of these rates are dependent upon soil properties, initial water content, water table location, and climatic conditions. Periodic mixing can improve material subsidence, but improving surface drainage and removing water rapidly were considered better alternatives in confined disposal areas. (Lisk-FIRL)
W79-06339

4B. Groundwater Management

CALIFORNIA GROUNDWATER REPORT: IT'S FINALLY IN,
For primary bibliographic entry see Field 6E.
W79-06002

SACRAMENTO VALLEY: A VAST UNDERGROUND RESERVOIR,
California State Dept. of Water Resources, Red Bluff. Northern District.
P. J. Lorens.
Pacific Groundwater Digest, Vol 2, No 2, p 8-12, February, 1979. 3 fig, 1 tab, 4 ref.

Descriptors: *Ground water basins, *Geohydrologic units, Irrigation wells, Withdrawal, Conjunctive use, Storage, Specific yield, Drillers logs, Water level, California, Sacramento Valley.

The ground water basin underlying the Sacramento Valley is second largest in California. It stores as much water as all the surface reservoirs in the state combined. There is a wide variation in ground water quantity and quality both between and within the geologic formations composing the basin. The use of ground water for irrigation in the valley has been steadily increasing since the early 1900's. By 1950 a pumping depression developed in Solana County due to increased ground water withdrawals. However, in recent years, ground water levels have been rising due to greater use of imported surface water. The largest pumping depression is in Sacramento County, the result of many years of pumping. With conjunctive-use management, ground water would be used during dry periods, and during the wet season, the basin would be recharged by percolation of streamflow, infiltration of unused irrigation water, and precipitation. The total volume of ground water in storage in the Sacramento Valley was estimated at 113,700,000 acre-feet for 1965 water level conditions in a depth zone ranging from 20 to 600 feet from the ground surface. This estimate was based on assigning specific yield values to materials described in driller's logs. (Purdin-NWWA)
W79-06006

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
For primary bibliographic entry see Field 6B.
W79-06008

DATING GROUND WATER.
For primary bibliographic entry see Field 2F.
W79-06016

NUMERICAL MODELLING OF AN AQUIFER SYSTEM WITH INTERMITTENT RECHARGE,
James Cook Univ., North Queensland (Australia). Dept. of Civil Engineering.
R. E. Volker.
Australian Water Resources Council Technical Paper No 25, 1977, 64 p, 26 fig, 47 ref.

Descriptors: *Digital computers, *Model studies, *Aquifers, Coasts, Groundwater recharge, Artificial recharge, Discharge(Water), Water levels, Saline water intrusion, Water management(Applied).

A digital model is presented which will evaluate the quantity and quality of groundwater from the Burdekin Delta on the North Queensland coast. The model takes into account both natural and artificial recharge conditions and the saline water-freshwater interface near the cost in predicting water levels at any particular time under the influence of given recharge or pumping rates. Results from the model indicate that average water levels in the last ten years would have been considerably lower if artificial recharge had not been carried out. One requirement of the model is a reliable method for determining recharge or discharge under assumed or actual climatic conditions. Also, needed are accurate field data from which recharge and discharge can be estimated. Models which determine seawater intrusion are also described and some results obtained from them are presented. Short term lowering of water levels will not result in significant intrusion. (Purdin-NWWA)
W79-06020

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
J. E. Terry, R. L. Hosman, and C. T. Bryant.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.90. Geological Survey Professional Paper 813-N, 1979. 41 p, 26 fig, 1 tab, 54 ref.

Descriptors: *Groundwater resources, *Evaluation, *Regional analysis, *Gulf Coastal Plain, Groundwater availability, Water quality, Water wells, Water yield, Aquifers, Water utilization, Water supply, Water demand, Water level fluctuations, Groundwater recharge, Surface-groundwater relationships, Saline water intrusion, Desalination, Aquifer management, Water conservation, Groundwater potential, *Lower Mississippi River basin.

The Lower Mississippi Region, and area of 102,400 square miles, lies mostly in the Gulf Coastal Plain physiographic province. Three small areas on the northwest boundary are in the Interior Highlands. An abundance of fresh ground water is available in the region--about 844 billion cubic feet annually. Only about one-third of this available supply is being used. The largest use of ground water in the region is for irrigation. Saltwater occurs throughout the region in the lower limits of the aquifers. The quantity of saltwater available is several times that of freshwater. As desalination techniques are perfected, and as more uses are found for saltwater, it will become an increasingly valuable resource. Water-resource development and related activities should include adequate consideration of ground water. Also, activities such as large-scale construction and mining excavations should be well planned and their impact upon the groundwater regime carefully evaluated. (Woodard-USGS)
W79-06308

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 5E.
W79-06341

4C. Effects On Water Of Man's Non-Water Activities

URBANIZATION AND CHANGES IN PRECIPITATION, A STATISTICAL APPROACH,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 2B.
W79-06248

HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1976,
Geological Survey, Austin, TX. Water Resources Div.
B. B. Hampton, and C. M. Wood.
Geological Survey open-file report 78-437, June 1978. 163 p, 4 fig, 3 tab, 7 ref.

Descriptors: *Urban hydrology, *Storm runoff, *Rainfall-runoff relationships, *Flood profiles, *Hydrologic data, Urban runoff, Streamflow, Hydrographs, Mass curves, Texas, *Dallas area.

This report contains rainfall and runoff data collected during the 1976 water year for drainage basins of Joes Creek, Bachman Branch, Turtle Creek, Coombs Creek, Cedar Creek, White Rock Creek, Elam Creek, Fivemile Creek, Newton Creek, Whites Branch, Prairie Creek, Tenmile Creek, Duck Creek, and South Mesquite Creek in the Dallas metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Detailed rainfall-runoff computations, including hydrographs and mass curves, are presented for six storm periods during the 1976 water year. During the 1976 water year, one continuous stream-gaging station and two flood-hydrograph partial-record stations were added to the study area. These stations are located in the Prairie Creek basin. (Woodard-USGS)
W79-06314

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-06473

4D. Watershed Protection

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 4. ANALYSIS AND ASSESSMENT OF SOIL EROSION IN SELECTED WATERSHEDS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Systems Div.
M. P. Keown, and H. W. West.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 347, Price codes: A06 in paper copy, A01 in microfiche. Technical Report M-77-4, February 1978. 82 p, 37 fig, 4 tab, 19 ref, 4 append.

Descriptors: *Watersheds(Basins), *Watershed management, *Fort Carson(CO), *Military reservations, *Soil erosion, *Watershed Erosion Index, *Environmental effects, *Military training areas, *Small watersheds, Baseline studies, Colorado, Resource management, Topsoil, Soil types, Rocky Mountain Region, Rainfall, Topography, Methodology, Analytical techniques, Sediments, Sedimentation, Land use, Universal Soil Loss Equation, Mathematical studies, Equations, Forecasting, Soil conservation, Mapping, Slopes.

The Watershed Erosion Index (WEI) was developed to predict average annual sediment yield for watersheds on Fort Carson military reservation, Colorado, two-thirds of which is intensively used for mechanical army infantry training. Training activities have seriously damaged trees and grass cover in this semiarid, fragile ecosystem. WEI, a modified version of the Universal Soil-Loss Equation, provides reliable engineering data in designing soil conservation measures. Soil losses in the six study watersheds were not significantly different from those of other small watersheds in the Rocky Mountain foothills region, but over most of Fort Carson the annual topsoil formation rate is probably less than the annual soil-loss rate because of: (1) the relatively slow rate of natural revegetation and vegetative growth due to low annual precipitation, (2) exposure of large training areas to wind erosion, and (3) the frequency and intensity of troop training. Recommendations: (1) further validate the methodology, (2) develop a computer program to calculate average annual sediment yield, (3) estimate effective life of other basins at Fort Carson that are silting in at a rapid rate, and (4) determine basin capacity required for sediment retention in all future engineering design studies for new construction at Fort Carson. Data requirements for WEI use include rainfall, soil erodibility, slope-length and gradient, and composite land use factors, and the percent of the watershed occupied by the field mapping unit. (Lynch-Wisconsin)
W79-06043

METHODS TO CONTROL FINE-GRAINED SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITY,
Hittman Associates, Inc., Columbia, MD.
M. A. Nawrocki, and J. M. Pietrzak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 092, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA 440/9-76-026, December 1976. 83 p, 11 fig, 11 tab, 39 ref, 1 append. 68-01-3260.

Descriptors: *Sediment control, *Construction, *Pollution abatement, Water pollution control, Erosion control, Particle size, Technology, Sediment transport, Suspended solids, Retention, Storage.

The most promising control alternatives for increasing the amount of fine-grained sediment retained at a construction site are summarized from current technology as described in literature. Use of a specific technique or combination of techniques depends upon the degree of fine-grained sediment control required and the characteristics of the soils at the site. The four general categories for the control of fine-grained sediment closely follow the implementation of a standard erosion and sediment control plan. The first category consists of standard techniques used on construction sites which tend to reduce the production of sediment at the site. The second category involves the use of adequate control measures including sediment traps, sediment filters and baffles, and sediment ponds to retain the fine-grained sediment on site. The third category involves the installation of mechanical separation devices capable of removing fine-grained particles from water at the overflow structure of the retention ponds. The last technology includes the removal, dewatering, drying, and perhaps, the use of the sedimentary materials. It is concluded that: overall control of fine-grained sediments can be achieved by modification and expansion of a standard erosion and sediment control plan; fences constructed of plastic filter cloth

appear to be one of the most effective control devices; and modifications of detention ponds including the installation of baffles and the provision of a more effective length to width ratio will achieve more removal of these sediments. (Davison-IPA)
W79-06101

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8D.
W79-06342

PLANTING GUIDELINES FOR MARSH DEVELOPMENT AND BANK STABILIZATION,
Coastal Engineering Research Center, Fort Belvoir, VA.
P. L. Knutson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 547, Price codes: A02 in paper copy, A01 in microfiche. Report CETA-77-3, 1977. 21 p, 3 fig, 2 tab, 9 ref, 3 append.

Descriptors: Erosion control, *Bank stability, Soil stabilization, *Marsh management, *Vegetation establishment, Marshes, *Marsh plants, Labor, *Planting management, Seeds, Fertilization.

Guidelines are presented for the use of marsh plants in stabilizing eroding banks and for marsh development. The selection of plants and planting methods and the determination of seed application rate and plant spacing are discussed. Determination of fertilization requirements and estimation of labor for planting on a project-by-project basis, are also discussed. Four types of cordgrass are considered including Smooth, Gulf Coast, California, and Saltmeadow. This report supplements Chapter 6 of the Shore Protection Manual of the US Army Corps of Engineers (1975). (Small-FIRL)
W79-06376

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
M. R. Sheinker, and R. Krumholz.
Water and Wastes Engineering, Vol 16, No 2, p 37-38, February, 1979, 2 fig.

Descriptors: *Nitrates, *Water quality control, *Monitoring, Ion exchange, Ground water, Denitrification, Human diseases.

Because of the strong correlation between high nitrate content in drinking water and the disease, methemoglobinemia, government regulations require continuous monitoring to see that the nitrate level does not exceed the 10 mg/l limit established as safe. The water treatment plant for Garden City Park, New York, uses a closed-loop ion exchange system to remove nitrates and an on-line Series 8138 S.I.E. analyzer to automatically and continuously measure the nitrate concentration of the denitrified product. The analyzer automatically shuts the system down if a level of 9.9 mg/l nitrate as nitrogen is detected or if a zero reading is recorded due to a reagent or analyzer failure. (Purdin-NWWA)
W79-06007

QUALITY ASSURANCE PROGRAM FOR TRACE HYDROCARBON ANALYSIS,
National Bureau of Standards, Washington, DC. Analytical Chemistry Div.
S. N. Chesler, H. S. Hertz, W. E. Wise, and S. A. Wise.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 1-10, October 1978. 3 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-6-022-11469.

Descriptors: *Laboratory tests, *Pollutant identification, *Oil pollution, Water pollution sources, Path of pollutants, Baseline studies, Environmental effects, Resources development, Water quality, Alaska, *Outer Continental Shelf, *Hydrocarbons, Quality control.

During the past year the National Bureau of Standards (NBS) has conducted an interlaboratory comparison study on samples of Mytilus homogenized by NBS and has acted as a consultant laboratory to other NOAA Principal Investigators involved in hydrocarbon analysis of marine waters, sediments and tissues. Results to date have shown that there is an urgent need for a strong quality assurance program within the Outer Continental Shelf plan. Since the chemical data reported to NOAA originates from several different laboratories, it is imperative that these data be uniform in quality so that there is a basis for comparability of the data. The experimental results of a sediment comparison study are summarized in tables and the methods used by each laboratory are also summarized in tabular form. (Sinha-OEIS)
W79-06021

IDENTIFICATION OF NATURAL AND ANTHROPOGENIC PETROLEUM SOURCES IN THE ALASKAN SHELF AREAS UTILIZING LOW MOLECULAR WEIGHT HYDROCARBONS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Cline, R. Feely, and A. Young.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 73-198, October 1978. 49 fig, 6 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Oil spills, *Pollutant identification, Path of pollutants, Water pollution sources, Resources development, Water pollution effects, Environmental effects, Alaska, *Outer Continental Shelf, *Hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons.

The development of petroleum resources in the Alaskan OCS may result in the release of toxic hydrocarbons to the marine environment. Increases in the natural levels of petroleum-derived hydrocarbons are likely to occur from the normal activities associated with exploration, production and transportation of crude and refined products within the region. Thus, it is of environmental significance that baseline levels of both naturally occurring and petroleum-derived hydrocarbons be established prior to the development of fossil fuel resources in the area, and that attention be focused in the sources and residence times of these components. The principal concern surrounding the distributions, sources, and sinks of low molecular weight hydrocarbons (LMWH) is not their direct impact on biota, but rather their role as tracers of more toxic hydrocarbon fractions commonly found in crude oils. Of particular value is the use of LMWH to identify probably trajectories of the toxic dissolved fractions during a spill, well blowout, or pipeline rupture. Because some of the hydrocarbons common to petroleum are also manufactured by marine organisms, it becomes necessary to evaluate the normal background levels of hydrocarbons before an accurate assessment of anthropogenic input can be made. The overall objective is to provide the criteria for an early warning detection of petroleum-derived hydrocarbons and to establish the feasibility of using LMWH as dispersion tracers, particularly in reference to near-bottom and resuspension processes. (Sinha-OEIS)
W79-06023

ASSESSING NITROGEN CONTAMINATION BY USE OF DIFFERENTIAL TEMPERATURE CALCULATIONS,
Whiteley-Jacobsen and Associates, Seattle, WA.
A. H. Benedict, and A. LeSouf.
Water Research, Vol 12, No 12, p 1107-1112, 1978. 8 fig, 2 tab, 13 ref.

Descriptors: *Nitrogen, *Aisne River(France), *Water pollution effects, *Equations, *Nitrogenous oxygen demand, *Biochemical oxygen demand, Carbon, Oxygen, Anaerobic conditions, Oxygen depletion, Rivers, France, Methodology, Analytical techniques, Mathematical studies, Industrial wastes, Municipal wastes, Water pollution sources, Pulp wastes, Ammonia, Ammonium, Oxygen requirements.

Nitrogenous oxidation accounts for about 38% of total oxygen demand requirements in the lower Aisne River, a subtributary of the Seine River in northern France, according to a methodology which defines the relative influences of nitrogenous and carbonaceous oxygen requirements. The methodology is based on definition of relative differences between BOD and nitrogenous oxygen requirements under warm (19-23C) and cold (2-6C) temperature regimes in the Aisne. The Aisne in the study area received point load contaminants from four industries (including a large ammonia-based pulping operation), the town os Soissons, and the Vesle River which receives wastes from the city of Reims. Mean monthly ammonia loadings to the Aisne were similar in winter and summer. Differential net nitrogen conversion resulting from the combined effects of ammonification and nitrogenous oxidation decreased with increasing flow rate (decreasing hydraulic residence time). At a flow of five cu m/sec there was a differential net conversion of 4.49 mg ammonium/l, while at a flow rate of 60 cu m/sec differential net conversion was 0.64 mg ammonium/l. Available data did not permit evaluation of the direct effect of ammonification. Anaerobic conditions could be expected in the Aisne if reaeration and photosynthetic oxygenation did not offset the requirements calculated. The relative influence of nitrogenous and carbonaceous oxidation would vary if other temperature regimes were used. (Lynch-Wisconsin)
W79-06034

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SOME PROBLEMS INVOLVED WITH SAMPLING GEOTHERMAL SOURCES,
Los Alamos Scientific Lab., NM.
A. K. Stoker, and W. D. Purtymun.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 67-95, May 1976. 7 fig, 1 tab, 12 ref. ERDA W-7405-ENG36.

Descriptors: *Geothermal studies, *Thermal water, *Sampling, *Data collections, Methodology, Variability, Water vapor, Steam, Condensation, Analytical techniques, Chemicals, Carbon dioxide, Chlorides, Laboratory tests, Flow, Flow rates, Radioisotopes, Wells, Water wells, Groundwater.

Geothermal wells must be sampled for a variety of purposes, including geologic and geological interpretation, engineering design of facilities, environmental release evaluation, and documentation of baseline conditions. Basic factors influencing the choice and application of sampling methods were reviewed, including the type of the geothermal resource, the analyses of interest, well production parameters, utilization processes, and possible sample contamination or instability. Three basic methods of sampling were described: condensation, phase separation, and use of evacuated containers. Several practical problems experienced by various workers were discussed. The problems discussed included the natural variability of fluid composition with time, effects of well-bore heat losses, effects of well flow rate and production time, sampling locations, laboratory simulation studies, contamination by corrosion reactions, and documentation of hydrologic systems possibly connected to the geothermal resource. (See also W79-06052) (Sims-ISWS)
W79-06055

DRILL STEM TESTING AND SAMPLING OF GEO-PRESSURED BRINES,
Halliburton Services, Duncan, OK.
A. G. Edwards, and J. M. Montgomery.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 97-113, May 1976. 5 fig, 6 ref.

Descriptors: *Geothermal studies, *Thermal water, *Drilling samples, *Pressure, Drilling, Wells, Sampling, Geology, Transmissivity, Groundwater, Brines, Equipment, On-site investigations, On-site data collections, Drill stem testing.

Technology and equipment are available today for obtaining samples and reservoir data on geo-pressured and most geothermal wells. The ultra-deep search for hydrocarbons has fostered development of subsurface equipment capable of withstanding pressure differentials of 10,000 psi at 500 F. This equipment has been used successfully in a limited number of geothermal wells, but the equipment has seen wide uses in the oil field. In addition to obtaining samples of the formation effluents, the following formation characteristics can be calculated: static reservoir pressure, indicated flow capacity, transmissibility, average effective permeability, damage ratio theoretical potential with damage removed, and the approximate radius of investigation. (See also W79-06052) (Sims-ISWS)
W79-06056

THE SALINITY PROFILE OF THE EAST MESA FIELD AS DETERMINED FROM DUAL INDUCTION RESISTIVITY AND SP LOGS,
Bureau of Reclamation, Boulder City, NV. Region 3.
For primary bibliographic entry see Field 2F.
W79-06057

FIELD SAMPLING OF RADIOACTIVE GEOTHERMAL EFFLUENTS,
LFE Environmental Analysis Labs., Richmond, CA.
For primary bibliographic entry see Field 2F.
W79-06058

UNION OIL COMPANY OF CALIFORNIA'S GEOTHERMAL SAMPLING TECHNIQUES,
Union Oil Co. of California, Brea.
For primary bibliographic entry see Field 2F.
W79-06061

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W79-06062

APPROACHES TO INTERPRETING ENVIRONMENTAL DATA,
Aerojet Nuclear Co., Idaho Falls, ID.
D. E. Michels.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 204-217, May 1976. 2 fig, 7 ref.

Descriptors: *Sampling, *Monitoring, *Environment, *Pollutants, Thermal water, Geothermal studies, Spatial distribution, Temporal distribution, Distribution patterns, Path of pollutants, Water pollution, Air pollution, Variability, Analytical techniques, Data collections, Data processing.

In order to establish standard or reference procedures aimed at regulation of geothermal sources, it is necessary first to study the patterns involved. In this way, the standardized parts of a procedure can be well-aimed at particular features which geothermal sources have in common in their own patterns of behavior or patterns of dispersion of their effluents. Comparability must be one of the motives behind setting up standardized procedures. Not all components of individual patterns are equally useful in comparing one geothermal source with another. It is necessary to learn which features are important to the purpose, either academic or regulatory, and then to focus the standardization of sampling toward those features. The interpretation of geothermal data must begin before the samples are taken. (See also W79-06052) (Sims-ISWS)
W79-06063

RADIATIVE PROPERTY MEASUREMENTS FOR SELECTED WATER SUSPENSIONS,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
F. P. Incropera, and K. G. Privoznik.
Water Resources Research, Vol. 15, No. 1, p 85-89, February 1979. 8 fig, 20 ref. NSF ENG75-17370.

Descriptors: *Light, *Light penetration, *Bodies of water, *Optical properties, Radiation, Waste water, Algae, Opacity, Laboratory tests, Absorption, Suspended solids, Particle size, Water pollution, Water pollution effects, *Radiative properties, Light scattering, Light extinction.

Although transport of the visible component of solar radiation in a water body strongly influences thermal structure and the growth of photosynthetic organisms, little is known about the inherent radiative properties which govern this transport. These properties include the extinction, scattering, and absorption cross sections, as well as the scattering phase function. In this study, systematic property measurements were made for two special cases: the wastewater suspension and the symbiotic algal culture. In both cases, extinction is dominated by scattering processes (rather than by absorption), but cross sections associated with the symbiotic cultures are typically a factor of 6 larger than those associated with the wastewater. In both cases, the scattering phase function is strongly peaked in the forward direction. (Sims-ISWS)
W79-06075

SENSITIVE, SPECIFIC FLUORESCENCE IMMUNOASSAY METHODS FOR DETECTING PESTICIDES AND OTHER ORGANIC ENVIRONMENTAL CONTAMINANTS ARISING FROM BIOLOGICAL OR CHEMICAL SOURCES,
IRT Corp., San Diego, CA.
H. R. Lukens, C. B. Williams, S. A. Levison, and W. B. Dandliker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 031, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. NSF/RA-770472, November 21, 1977. 94 p, 28 fig, 12 tab, 23 ref, 4 append. AEN 74-09725A01.

Descriptors: *Pesticides, *Pollutant identification, *Immunoassay, *Organic pesticides, Organic compounds, Diquat, Hexachlorophene, Diethylstilbesterol, Fluorescence, Analytical techniques, Environmental effects.

An immunoassay is described which has been successfully applied in detecting three contaminants of current concern: diquat, hexachlorophene, and diethylstilbesterol. The early stages of the development of a portable fluorescence polarimeter are described. The basic technique in the immunoassay involves the use of an antibody to the specific contaminant, followed by contaminant detection with fluorescence polarization or intensity measurements. The use of ionizing radiation for developing complex conjugate antigens is examined. Not previously reported, this technique significantly reduces the cost of producing these complex conjugates compared to conventional chemical synthesis techniques. (Davison-IPA)
W79-06105

BIOCHEMICAL OXYGEN DEMAND MEASURING DEVICE,
A. R. F. Products Inc., Raton, NM.
L. G. Stolarczyk.
United States Patent No. 4,105,523. Issued August 8, 1978, 9 p. 7 claims. 3 fig.

Descriptors: *Patents, *Biochemical oxygen demand, *Instrumentation, *Water analysis, Testing, Sampling, Water properties, Water pollution, Oxygen, Electrolysis.

The sample to be tested is placed in a sealed reaction chamber large enough to provide an air space above the sample. An oxygen generator including an electrolytic cell is placed in communication with the reaction chamber. The pressure in the air space in the chamber is sensed and the sensing is used to actuate a switch to supply electric current to the electrolytic cell. Operation of the cell supplies oxygen to the air space to replace that consumed by the sample, and the resultant rise in pressure deactivates the switch. The current is supplied in the form of uniform pulses; hence the number of pulses supplied to the cell is a measure of the oxygen produced by the cell as well as a measure of the BOD of the sample. (Lynch-IPC)
W79-06116

BOD TEST VARIABLES,
New Brunswick Dept. of Fisheries and Environment, Fredericton. Environment Div.
D. G. Morrissette, and D. S. Mavinic.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, p 1213-1222, December, 1978. 3 fig, 12 ref, 4 tab.

Descriptors: *Biochemical oxygen demand, *Water analysis, *Water pollution, Turbulence, Turbidity, Light, Mixing, Testing, On-site tests, Laboratory tests, Water pollution sources, Streams, Natural streams, Surface waters.

It has been reported that the oxidation rate in a natural stream is higher than the rate obtained from the corresponding laboratory BOD test. This study was undertaken to observe the effect of stream conditions, such as turbulence, light, and turbidity, separately and in combinations, on the BOD test, using raw domestic sewage. Mixing was found to increase the 5-day BOD by an average of 15%, while light increased the BOD by only 4%. Turbidity demonstrated an average reduction of about 24% on BOD values. Mixing and turbidity, in combination, reduced the BOD by 28%, turbidity and light by less than 6%, light and turbidity and mixing by 26%, while mixing and light increased the BOD by about 15%. Thus, extrapolation from laboratory to field conditions, from the existing standard BOD test, yields questionable results. Inclusion of the physical characteristics of the stream in the BOD test is a possible approach to obtaining more meaningful results. (Witt-IPC)
W79-06126

DIRECT AND INDIRECT IMMUNOFLUORESCENCE STAINING OF FECAL STREPTOCOCCI FOR RAPID ASSESSMENT OF WATER QUALITY,
Brookhaven National Lab., Upton, NY.
M. T. Pavlova, E. Beauvais, F. T. Brezenski, and

W. Litsky.
Available from the National Technical Information Service, Springfield, VA 22161 as BNL-23328, Price codes: A02 in paper copy, A01 in microfiche. Presented in part at the Third Conference of the Society of Applied Microbiology, Cairo, Egypt, November 4-9, 1975. 22 p, 6 tab, 13 ref.

Descriptors: *Analytical techniques, *Sewage bacteria, *Streptococcus, *Fluorescence, Water pollution, Waste water, Sewage, Laboratory tests, *Water quality.

An attempt was made to develop a rapid test for the identification of fecal streptococci using immunofluorescence (IF) techniques. Using direct and indirect staining methods with pooled conjugates, it was possible to obtain 81% and 96% positive IF reactions, respectively. All IF cross-reactions observed with non-fecal streptococci and staphylococci were eliminated by trypsinization of the smears prior to direct staining. Trypsinization of the smears did not eliminate all IF cross-reactions when indirect staining methods were used. The direct staining method was not as sensitive as the indirect staining method, but it was specific, rapid, simple, economical, and applicable for rapid identification of fecal streptococci. Using IF techniques, fecal streptococci was identified in water and sewage samples within 20 hr. Conventional biochemical and serological tests may take as long as 7 to 14 days. Thus, IF techniques could possibly be automated for use in continuous monitoring systems. (Small-FIRL)
W79-06133

CHRYSOTILE ASBESTOS DILUTION STUDIES,
Ontario Ministry of the Environment, Toronto.
R. B. Hunsinger, and K. J. Roberts.
Technical Report 66. 1977. 10 p, 2 tab, 3 ref. 1 append.

Descriptors: *Asbestos, *Suspended solids, Turbidity, *Polyelectrolytes, Measurement, *Analytical techniques.

The simple dilution of concentrated asbestos suspensions in various distilled water-river water mixtures was studied. Consistently accurate quantitative analysis of chrystotile asbestos particles in the water mixtures was not possible. Generally the counts made after dilution of the concentrated particles ranged from the anticipated concentration to one or two orders of magnitude below that concentration. No correlation was found between the turbidity of the dilution water used and the resultant asbestos counts. The addition of polyelectrolytes to effect peptization prior to dilution led to more consistent asbestos counts after dilution. The use of peptization for the preservation of samples stored for asbestos analysis should be explored. (Small-Firl)
W79-06153

MODELING WATER QUALITY IN RIVER BASINS,
Kharkov Vodokanalniiproekt Inst. (USSR).
Ye. V. Yeremenko.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 55-89, September 1978. EPA-600/9-78-024. 11 fig, 17 ref.

Descriptors: *Water quality, *River basins, *Mathematical models, *Pollutants, *Evaluation, *Management, Channels, Algorithms, Hydraulics, Equations, Systems analysis, Diffusion zone, Three-dimensional problems, One-dimensional problems.

The appropriateness of specific waters for particular uses is determined by the combination of physical, chemical, and biologic criteria. However, current mathematical models of water quality use mainly physical criteria. The bases for mathematical models are hydrodynamic or hydraulic equations, and the turbulent diffusion equations for calculating pollutant concentrations with some allowance for nonconservative properties. Depending on whether the size of a river basin section or the whole river basin is considered, different data needs on pollutant concentration in the river are required. If a long stretch of watercourse is considered, it is expedient to use one-dimensional solutions; otherwise a two- or three-dimensional solution should be utilized. The zone within which the pollutant concentration is not completely mixed in the cross-section is called the three-dimensional diffusion zone. Considered is the calculation of the pollutant concentration in this zone. Discussed also are the evaluation of pollution concentration in one-dimensional problems and the solution of some problems of water quality management. (See also W79-06166) (Bell-Graf--Cornell)
W79-06169

MANAGEMENT DECISIONS FOR LAKE SYSTEMS BASED ON A SURVEY OF TROPHIC STATUS, LIMITING NUTRIENTS, AND NUTRIENT LOADINGS,
Corvallis Environmental Research Lab., OR.
A. F. Bartsch, and J. H. Gakstatter.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 372-394 (Discussion p 395-396), September 1978. 9 fig, 3 tab, 20 ref. EPA-600/9-78-024.

Descriptors: *Lakes, *Management, *Trophic level, *Model studies, *Nutrients, Decision making, Surveys, Eutrophication, Water quality, Reservoirs, Phosphorus, Northeast US, Watersheds(Basins), Algal assay, Vollenweider model, Ontario(Can).

The broad objectives of the National Eutrophication Survey, started in 1972 by EPA, were to identify lakes and reservoirs which receive effluents from municipal sewage treatment facilities and to determine the significance of these point-source nutrient inputs through field investigation. These goals have since been modified to include the relationships between drainage area characteristics and nutrient runoff to develop water quality criteria for nutrients. 812 water bodies distributed across the country were selected for a continuing study. For each lake, information has been sought for making management decisions for control of point and nonpoint sources of phosphorus and other nutrients. The existing trophic conditions were evaluated by sampling and an algal assay was performed to determine whether or not phosphorus, nitrogen, or other elements limited the productivity of the system; used where UH-1H Bell helicopters. Herein, three general models from the literature have been presented which relate total phosphorus to lake response. (See also W79-06166) (Bell Graf-Cornell)
W79-06181

DESCRIPTIVE SIMULATION MODEL FOR FORECASTING THE CONDITION OF A WATER ECOSYSTEM,
Scientific Research Institute of Engineering and Applied Mathematics, Rostov-na-Donu (USSR).
A. B. Gorstko.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 433--439 (Discussion p 440-441), September 1978. 2 fig. EPA-600/9-78-024.

Descriptors: *Ecosystems, *Water quality, *Simulation analysis, *Model studies, *Azov Sea(USSR), Effects, Computers, Biomass, Algorithms, Forecasting, Equations, Systems analysis.

Sophisticated computers are needed to forecast effects of human activity on aqueous ecological systems. Development of a mathematical model depends upon information available on processes occurring within the ecosystem being studied; model selection is based on the volume of accumulated information. For unique water bodies where the ecosystem has been studied for dozens of years the best model is the so-called descriptive simulation system. Any acceptable model for forecasting must fulfill five requirements. As an example, the simulation model of the Azov Sea, developed at the Scientific Research Institute of Mechanics and Applied Mathematics, is described herein. The Azov Sea is subdivided into seven segments; the ecosystem in each segment is described by a state vector, the components of which are concentrations of different substances in water and the biomass of specific animals and plants. The most acceptable verification and model refinement can be achieved by testing the algorithm with real data. The basic concepts herein will be used to simulate Lake Baikal. (See also W79-06166) (Bell-Graf-Cornell)
W79-06183

MATHEMATICAL ECOSYSTEM MODELS AND DESCRIPTION OF THE WATER QUALITY IN WATER BODIES,
R. A. Poluektov.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 442-450, September 1978. 4 fig, 8 ref. EPA-600/9-78-024.

Descriptors: *Water bodies, *Water quality, *Ecosystems, *Model studies, Effects, Behavior, Equations, Simulation analysis, Systems analysis, Methodology, Water biogenosis.

It is essential to construct quantitative models to reflect the behavior of existing natural systems and to forecast the impact of man's controlling actions on these systems. So far in ecosystem modeling, the problem of the specific processes of interactions among different biological species and environmental factors has not been considered. In the work reported herein, the possible outputs from specially constructed systems of differential equations were studied on a comparatively abstract level. The biological interpretation of results reflects subjective views of the investigator rather than the existing situation. Summarized is the general outline of a needed common-point-of-view approach for describing ecosystems. Discussed are principles of ecosystem modeling and modeling methods. Considered are models of interseasonal dynamics of water ecosystems, a model of seasonal dynamics of water ecosystems, and a model of diurnal activity. These dynamic models of water biogenosis can be examined as a hierarchical system of models. (See also W79-06166) (Bell Graf-Cornell)
W79-06184

ACUTE TOXICITY OF COPPER TO SOME FISHES IN HIGH ALKALINITY WATER,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5C.
W79-06235

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

MODE OF ELEMENTAL DISSIPATION FROM ASH BASIN EFFLUENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
D. S. Cherry, and R. K. Guthrie.
Water, Air, and Soil Pollution, Vol 9, No 4, p 403-412, May 1978. 3 fig, 4 tab, 11 ref. AEC AT(38-1)-824.

Descriptors: *Fly ash, *Chemicals, *Water pollution, On-site investigations, On-site data collec-

tions, Chemical analysis, Neutron activation analysis, Elements(Chemicals), Pollutants, Pollutant identification, Path of pollutants, Effluents, Biology, Biota, Benthos, Sediments, Water quality, Pollutant dissipation.

The dissipation of chemical elements from ash basin effluent was determined by use of neutron activation analysis of sediment, water, plant, invertebrate, and vertebrate samples taken from successive sites through the drainage system. Samples were tested for concentrations of 40 elements for a 12 month period. Three different modes of dissipation were found. The major mechanism for removal of chemical elements from effluent was sedimentation into the benthic sediment. All biota had greater concentrations of chemicals than did water, with invertebrates having slightly higher levels than did plants and vertebrates. Ten elements were more concentrated in at least one biotic group than in the sediment. Concentrations of 6 elements in the drainage system exceeded the EPA recommended limits for surface waters. The observed modes of dissipation in this aquatic system emphasize the necessity for stable biotic communities present to permit cycling of chemical elements. (Sims-ISWS)
W79-06265

VIRAL AND BACTERIAL AEROSOLS AT A WASTEWATER SPRAY IRRIGATION SITE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5D.
W79-06385

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, I. BACTERIOLOGICAL WATER QUALITY,
New Mexico Univ., Albuquerque. Dept. of Biology.
C. S. White, J. R. Gosz, and D. I. Moore.
Water, Air, and Soil Pollution, Vol 10, No 1, p 71-79, July 1978. 2 fig, 5 tab, 8 ref.

Descriptors: *Water quality, *New Mexico, *Watersheds(Basins), *Mountains, *Skiing, Coliforms, Streptococcus, Bacteria, Water pollution, Water pollution sources, Land use, Sewage treatment, Septic tanks, Salts, Recreation, Recreation facilities, Recreation wastes, Effects, Potable water, Sampling, Analysis, *Santa Fe(NM), Ski basin impact.

Stream samples were taken at 1 control area above and 2 areas below the Santa Fe Ski Basin. Samples were analyzed for total coliform, fecal coliform, and fecal streptococci. The average ratio of fecal coliform to fecal streptococci below the ski basin was actually lower than the average ratio at the control site. The lower ratio indicates no further contamination from human sources below the ski basin. The coliform colonies isolated were probably from mammals other than human or from human sources other than the sewage disposal system at the ski basin. The few colonies isolated from the stream indicate that the water is not potable during certain seasons. (See also W79-06391) (Sims-ISWS)
W79-06390

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, II. HEAVY METALS,
New Mexico Univ., Albuquerque. Dept. of Biology.
D. I. Moore, J. R. Gosz, and C. S. White.
Water, Air, and Soil Pollution, Vol 10, No 1, p 81-93, July 1978. 7 tab, 16 ref.

Descriptors: *Water quality, *Watersheds(Basins), *Mountains, *Heavy metals, Skiing, Recreation facilities, Streams, Snowpacks, Lichens, Sampling, Chemical analysis, Pollutant identification, Chemicals, Metals, Pollutants, Water pollution, Water pollution sources, Path of pollutants, Ski basin impacts, Automobile exhaust.

The input of heavy metals by automobile exhaust pollution associated with the ski basin activities was the primary concern of this paper. Stream, snowpack, and lichen samples were collected and analyzed for Pb, Zn, and Cu. Some lichen samples were also analyzed for Ca, Mg, Na, K, Fe, and Mn, as well as Pb, Zn, and Cu. Snowpack samples from roadside areas demonstrated increased levels of Pb and Cu in comparison to areas up to 180 m from the road, but heavy metal levels at more remote areas were comparable to roadside levels. In all snow samples, the heavy metals associated with the particulate matter were the major form of all inputs. Heavy metals in streams were also highly correlated with the particulate matter content. Heavy metal inputs to the watershed were greater than stream export, indicating an accumulation of heavy metals by the system. The forest canopy appears to be the major factor in the accumulation of heavy metals, probably due to better interception and impaction of the particulate matter by the canopy. (See also W79-06390) (Sims-ISWS)
W79-06391

POLLUTION PROFILE OF A RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
A. C. Paul, and K. C. Pillai.
Water, Air, and Soil Pollution, Vol 10, No 2, p 133-146, August 1978. 6 fig, 7 tab, 9 ref.

Descriptors: *Water pollution, *Pollutants, *On-site investigations, *Pollutant identification, Rivers, Sediments, Sediment transport, Path of pollutants, Water pollution sources, Industries, Effluents, Chemicals, Metals, Chlorides, Fertilizers, Nutrients, Radioactive wastes, Chemical analysis, Sampling, *Periyar River(India), *India.

A host of chemical industries subject the Periyar River, India, to pollutants such as acids, alkalies, and their salts and trace metals and radionuclides belonging to the Th and U chains. Proximity of different outfalls and poor lateral mixing in the river are responsible for high local aquatic concentrations. Scavenging reactions, in situ, and sedimentation of suspended matter result in the accumulation of radionuclides near the outfall area. Monsoons 'flush out' the river into the backwater area, and translocation of sediments is the major factor in the transport of pollutants. (Sims-ISWS)
W79-06397

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W79-06398

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDIMENTS OF LAKES SUPERIOR AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W79-06399

CONCEPTUAL FRAMEWORK FOR COORDINATED GREAT LAKES MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W79-06402

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
R. L. Fox, and R. M. Eddy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 136, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-908/2-77-005, December 1977. 104 p, 20 fig, 9 tab, 17 ref, 1 append.

Descriptors: *Water quality, *Monitoring, *Sampling, *Water quality standards, *Utah, Rivers, Sediments, Suspended solids, Turbidity, Water chemistry, Chemicals, Pollutants, Pollutant identification, Water pollution, Water pollution sources, Biology, Biological properties, Benthos, Benthic fauna, Water temperature, Streamflow, Hydrogen ion concentration, *Virgin River(Utah).

The Technical Investigations Branch of the Environmental Protection Agency, Region VIII, conducted an intensive water quality study in the Virgin River and Kanab Creek drainages in southwestern Utah in March, 1976. The study was requested by the Five County Association of Governments, the local '208' water quality management planning agency. Water, sediment, and benthic samples were collected at selected locations throughout a total stream reach of 174 km. Study results indicated a gradual degradation of water quality downstream from Zion National Park. Violations of recommended criteria/standard levels were most common for the salinity parameters, but concentrations of arsenic, iron, manganese, and mercury also exceeded recommended levels. In addition, high concentrations of suspended solids impaired the quality of water throughout much of the study area. (Sims-ISWS)
W79-06423

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT: VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
Southern California Ocean Studies Consortium, California State University and Colleges Long Beach, California. Dailey, M.D.; Hill, B.; and Lansing, N. (Eds.). September, 1974. BLM-08550-CT4-1.

Descriptors: *Baseline studies, *Resources development, *Environmental effects, *Water pollution sources, *Water pollution effects, Geology, Climatology, Oceanography, Oil pollution, Heavy metals, Thermal pollution, Biota, Economics, Social aspects, *Outer Continental Shelf, *Environmental impact, Southern California Bight.

A report which offers a description of the economic and physical forces, and biological and social resources existing in the Southern California Continental Borderland Area provides the basis for analyzing the feasibility of offering some of the Area for future mineral development, and assessing the environmental impacts that might result from a proposed leasing action. The subject matter has been grouped into three volumes which reflect the major disciplines as examined: I. Physical Environment; II. Biological Environment; III. Social and Economic Elements. Each volume includes a master bibliography for its contents. Each of the twenty-two separate chapters is essentially self-contained and intended to stand alone as a summary of the available knowledge in that subject. (See W79-06450 thru W79-06463) (Sinha-OEIS)
W79-06449

5B. Sources Of Pollution

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. C. Burrell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 199-494, October 1978. 44 fig, 59 tab, 12 ref, 6 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Baseline studies, *Heavy metals, *Sediments, *Bacteria, *Benthos, Water pollution sources, *Cadmium, Biota, Toxicity, Coasts, Estuaries, Shellfish, Mammals, Selenium, Manganese, Nickel, Alaska, *Outer Continental Shelf.

The data indicate that the sediments, water and indigenous biota of the Alaskan shelf and coastal waters have heavy metal contents which are as low or lower than those recorded elsewhere for similar unpolluted oceanographic environments in more temperate regions. The sediments contain concentrations of extractable trace metals which are a function of the grain size distribution, for example and, as would be expected, no unnatural enrichments have been recorded. Similarly, the means for the soluble contents of metals in the water column correspond to those recorded for open ocean areas anywhere. Enhanced values adjacent to the bottom were commonly observed; this is here likely to be due to the incorporation of fine grained particulate and colloidal material rather than, say, regeneration of metals from biota debris but is, in either case, a natural feature. The most comprehensive set of data are for marine mammals from the Bering Sea. Relatively enhanced values for toxic metals such as cadmium in kidney and liver samples are recorded. A major effort has been concerned with the uptake of heavy metals by natural marine sediment bacteria populations and transfer to the deposit feeding benthos. Initial results show that cultured heterogenous marine bacteria strongly concentrate cadmium and that, when used as a food source by detritivore clams, they later show elevated (though not magnified) concentrations. (Sinha-OEIS)
W79-06024

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.
W79-06025

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM LOWER COOK INLET,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
S. Brenner, I. R. Kaplan, M. I. Venkatesan, J. Bonilla, and E. Ruth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 589-621, October 1978. 4 fig, 7 tab, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35250.

Descriptors: *Analysis, *Organic matter, *Baseline studies, *Sediments, *Water pollution sources, Paths of pollutants, Oil pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Petroleum hydrocarbons, *Biogenic hydrocarbons.

A large portion of the effort in the past contract year has been devoted to the development of reliable extraction and analysis procedures. Satisfactory analysis of sediment samples containing even every small amounts of organic components can now be performed. All Lower Cook Inlet samples from 1876-1977 cruises have been analyzed and the data processed. Analyses of samples from the other regions of Alaska OCS is nearly complete as well. Each sample was analyzed for: (1) total carbon content, (2) organic carbon content, (3) sulfur content, (4) aliphatic hydrocarbons, and (5) aromatic hydrocarbons. No signs of petroleum hydrocarbons input were detected, hence the organic content of the sediments is biogenic, derived from terrestrial and marine sources. Since it was possible to distinguish between marine and terrestrial sources of hydrocarbons, this information should allow the prediction of the fate of petroleum introduced into Lower Cook Inlet through routine activity or through accidental spillage. (Sinha-OEIS)
W79-06026

LONGITUDINAL DISPERSION WITH NON-LINEAR ADSORPTION IN POROUS MEDIA,
Maryland Univ., College Park. Water Resources Research Center.
T. Tagamets.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 578, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 52(6), (1973), 93 p, 15 fig, 45 ref, 2 append. OWRT A-023-MD(2). 14-31-0001-5020.

Descriptors: Ground water, Adsorption, Pollutant removal, Longitudinal dispersion, Porus media, *Path of pollutants, *Groundwater, Pollutant dispersion, Soil water movement.

Evaluation and quality control of ground water requires a better understanding of the physicochemical processes that determine the degree of retention or movement of pollutants in ground water. The distance that a polluting substance moves in soil depends on physical and chemical parameters. The physical parameter can be described as a transport step and the chemical parameter as an attachment step. To predict movement of a pollutant through soil requires that both parameters be incorporated in a predictive model. The adsorption of many solutes on activated charcoal and soils follow a non-linear rather than a linear isotherm. A one-dimensional dispersion equation subject to a non-linear isotherm has been formulated and solved using a finite difference scheme. A comparison between the theoretical results and some experimental data is presented.
W79-06027

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL ENERGY DEVELOPMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-06053

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
L. Schieler.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 36-66, May 1976. 12 tab, 11 ref.

Descriptors: *Geothermal studies, *Thermal water, *Pollutants, *Toxins, Hydrogen sulfide, Ammonia, Chemicals, Salts, Gases, Radioisotopes, Radioactive wastes, Water pollution, Water pollution sources, Effluents, Hazards, Groundwater.

Exploitation of geothermal resources is hampered by a lack of understanding of the basic chemical interactions and toxicity hazards associated with the gaseous and aqueous effluents characteristic of various geothermal areas. The objective of this paper was the evaluation of the relative hazards of the various effluents in both liquid- and vapor-dominated fields in terms of concentration and chemical toxicity effects. Many chemical species must be considered in evaluating liquid-dominated systems, but only a few volatile species are significant in vapor-dominated systems. This is a direct consequence of the thermodynamic equilibria established among the chemical elements over the wide range of temperatures encountered in various geothermal areas. Vapor-dominated systems are lacking the aqueous phase required for dissolving water soluble salts. Since water is present as steam rather than as liquid, vapor-dominated systems tend to be lower in total dissolved solids than liquid-dominated systems. Volatility is the primary transport mechanism in vapor-dominated systems. (See also W79-06052) (Sims-ISWS)
W79-06054

APPROACHES TO INTERPRETING ENVIRONMENTAL DATA,
Aerojet Nuclear Co., Idaho Falls, ID.
For primary bibliographic entry see Field 5A.
W79-06063

DISPERSION OF SOLUBLE POLLUTANTS I NON-UNIFORM RIVERS, I. THEORY,
Commonwealth Scientific and Industrial Researc Organization, North Ryde (Australia).
B. M. Chapman.
Journal of Hydrology, Vol. 40, No. 1/2, p 139-15 January 1979. 6 fig, 7 ref.

Descriptors: *Dispersion, *Pollutants, *River *Model studies, Mathematical models, Theoretica analysis, Equations, Non-uniform flow, Mixing Velocity, Diffusion, Convection, Path of pollu ants, Water pollution, Flow, Hydrology, Solubl pollutants.

An analytical framework was developed to repre sent the solute dispersion behavior of a river whos local average velocity, flow rate, and dispersio characteristics vary along its length. A coordinat transformation through which the concept of dispersion coefficient was replaced by that of characteristic time allows the use of dimensionles equations. By measuring concentration-time pro files at various stations downstream from a poin where a slug of pollutant is instantaneously re leased, it was possible to determine the variation o the characteristic time of the river along its length (See also W79-06066) (Sims-ISWS)
W79-06065

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, II. APPLICATION TO EXPERIMENTAL RESULTS,
Commonwealth Scientific and Industrial Research Organization, North Ryde, (Australia).
B. M. Chapman.
Journal of Hydrology, Vol. 40, No. 1/2, p 153-163 January 1979. 9 fig, 1 tab, 4 ref.

Descriptors: *Dispersion, *Pollutants, *Rivers *Model studies, Mathematical models, Theoretica analysis, Equations, On-site investigations, Dye releases, Nonuniform flow, Mixing, Diffusion, Velocity, Path of pollutants, Water pollution, Flow, Hydrology, Soluble pollutants.

The use of the theory of dispersion in non-uniform rivers, presented in Part I of this series, was demonstrated using 2 sets of previously published experimental results. The first set of data was obtained at 2 downstream stations following an accidental spill of chloroform in the Mississippi River. The second set of data involved the measurement of concentration-time profiles following the intentional release of soluble dye in a creek. Very satisfactory fits of the data with the theory were obtained in both cases. A final example illustrated how a general concentration-time profile obtained at one station may be used to predict the profile when it reaches a second station further downstream. All calculations were carried out on a programmable pocket calculator. (See also W79-06065) (Sims-ISWS)
W79-06066

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
M. E. Exner, and R. F. Spalding.
Water Resources Research, Vol. 15, No. 1, p 139-147, February 1979. 3 fig, 6 tab, 36 ref.

Descriptors: *Water pollution, *Nebraska, *Groundwater, *Correlation analysis, Water pollution sources, Fertilizers, Statistical models, Irrigation, Sampling, Water analysis, On-site data collections, Sands, Agriculture, Graphical analysis, Water quality, Nitrates, Model studies, *Holt County(NB), Vertical permeability, Nonpoint-source pollution, Point-source pollution.

The theoretical absence of the in situ formation of most common mineral phases and the high vertical permeability of the relatively inert soils and unsaturated layer permit detection of man-induced environmental changes in the dilute groundwater of Holt County. Correlation coefficients show many significant associations for the major ions in groundwater affected by point and nonpoint-

source contamination. Large areas of nonpoint contamination are attributed to fertilization and irrigation of the sandy soils. In these areas, increases in the average annual groundwater concentrations of Cl(-), SO4(2-), and NO3(-) average 0.44, 0.57, and 4.9 mg/l/yr, respectively. A proposed model suggests that 50% of the applied nitrogen fertilizer infiltrates to the groundwater reservoir. (Visocky-ISWS)
W79-06071

SYMPOSIUM ON ENVIRONMENTAL TRANSPORT AND TRANSFORMATION OF PESTICIDES: JOINT U.S.--U.S.S.R PROJECT 02.03-31, 'FORMS AND MECHANISMS BY WHICH PESTICIDES AND CHEMICALS ARE TRANSPORTED'.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 714, Price codes: A11 in paper copy, A01 in microfiche. Report No EPA-600/9-78-003, February 1978. Symposium held in Tbilisi, USSR, October 20-27, 1976, 252 p, 62 fig, 29 tab, 399 ref. Environmental Research Laboratory, Athens, GA.

Descriptors: *Pesticide kinetics, *Pesticide residues, *Pesticide drift, *Pesticides, Movement, Path of pollutants, Soil water, Translocation, Pollutants, Chemical wastes, Soil contamination, Water pollution, Mathematical models, Absorption, Adsorption, Distribution patterns, Volatility, Persistance, Animal metabolism, Agricultural chemicals, Environmental impact.

The extended abstracts of 26 papers presented on the movement and transformations of pesticides in the atmosphere, in soils, in water, in plants, and in animals are compiled. The use of mathematical modeling to describe the transport and transformation of pesticides in the environment is reported. The state of the art in each country and results of research on particular aspects of the topic are presented. (Davison-IPA)
W79-06098

PHOSPHORUS INTERACTIONS IN THE AQUATIC ENVIRONMENT: A SURVEY OF THE LITERATURE,
Vermont Univ., Burlington. Water Resources Research Center.
D. W. Meals, Jr., and E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 418, Price codes: A06 in paper copy, A01 in microfiche. Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont, February, 1978. 104 p, 25 fig, 10 tab, 127 ref. OWRT A-036-VT(1).

Descriptors: *Phosphorus, *Aquatic plants, *Wetlands, Lakes, Streams, Marsh plants, Absorption, Sediments, Bibliographies.

The mechanisms by which phosphorus is retained in wetlands are: physical entrapment of particulate phosphorus, chemical sorption of P by organic matter and soil materials, and biological utilization of P by microorganisms and macrophytes. Many rooted aquatic plants are highly effective in removing phosphorus from water and are even capable of storing excess phosphorus in their tissues. Some wetland vegetation act to pump phosphorus from the sediments to the water through release of phosphorus from leaf tissue. Rapid decomposition of wetland plants may also release phosphorus to water. In streams, there are relationships between P concentration and stream flow. These are: the dilution effect, an inverse correlation between stream flow and concentration caused by dilution of point source P inputs by stream flow; and the runoff effect, P concentration increase with increasing stream flow caused by contribution of P from land runoff during high flow. Adsorption by sediments and biological uptake by periphyton are the most important mechanisms for P removal. Lake sediments typically contain very large quantities of P, frequently exceeding the total mass of P present in the lake water. Phosphorus tends to be adsorbed by sediment materials under aerobic conditions and desorbed under anaerobic conditions. (Steiner-Mass)
W79-06109

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT. APPENDEX F. REPORT ON HAZARDOUS WASTE DISPOSAL.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Water Quality Board.
1978. 34 p, 2 append.

Descriptors: *Great Lakes region, *Hazards, Toxins, *Industrial wastes, Water pollution, Waste water treatment, *Liquid wastes, Energy, Waste disposal, Regulation.

Problems generated by hazardous waste disposal in the Great Lakes Drainage Basin are reviewed. Although reasonable treatment techniques exist, current liquid industrial waste management does not sufficiently considered waste characteristics, environmental hazards, long term effects, or possible benefits from reclamation of recoverable energy components of wastes. Possible treatment techniques are reviewed. The Water Quality Board recommends the development of compatible programs and regulations for the managment of hazardous wastes be developed and enforced. These programs should be national in scope. (Small-FIRL)
W79-06110

MATHEMATICAL MODELING OF THE HYDRODYNAMICS AND DISPERSION OF CONTAMINANTS IN THE NEARSHORE,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geology.
W. Lick.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 282-312 (Discussion p 313-315), September 1978. 19 fig, 1 tab, 13 ref. EPA-600/9-78-024.

Descriptors: *Model studies, *Hydrodynamics, *Dispersion, *Contaminants, *Lakes, *Lake Erie, *Water pollution, *Nearshore regions, Numerical analysis, Wind, Lake currents, Depth, Velocity, Powerplants, Discharge(Water), Surface temperature, Bottom topography, Thermal plumes, Equations, Open-lake waters, Prediction, Systems analysis.

Because of possible harmful effects of contaminants, it is necessary to be able to predict their dispersion and fate in large lakes. The nearshore regions of these lakes are especially important; recent studies have demonstrated significant differences between nearshore and open-lake waters. First of all, the nearshore regions are where contaminants are generally introduced; secondly, the nearshore regions are of more interest to use for such uses as recreation, water supplies, and fishing. As part of a research effort sponsored by the U.S. Environmental Protection Agency, numerical models have been developed which can realistically describe the currents and dispersion of contaminants throughout large lakes and especially in the nearshore hydrodynamic and dispersion models, which necessarily include procedures for coupling the nearshore and offshore lake circulations. Specific applications have been made to predict the dispersion of contaminants under specific conditions and to understand the physical consequences. Presented are these specific examples: (1) the wind-driven currents, both open-lake and nearshore, in Lake Erie under steady-state, constant density conditions; (2) the dispersion of a contaminant from a river into Lake Erie by wind-driven currents under present conditions and as modified by proposed large man-made islands such as a jetport in the lake; and (3) the dispersion of heat in the discharge from a power plant on Lake Michigan. Presented are a constant-density, steady-state model and a variable-density, time-dependent model; both are fully three-dimensional and give all three components of velocity at any point in the lake. (See also W79-06166) (Bell Graf-Cornell)
W79-06178

MATHEMATICAL MODELING STRATEGIES APPLIED TO SAGINAW BAY, LAKE HURON,
Environmental Protection Agency, Grosse Ile, MI.
V. Bierman, W. Richardson, and T. T. Davies.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 397-430, September 1978. 19 fig, 1 tab, 48 ref. EPA-600/9-78-024.

Descriptors: *Model studies, *Lake Huron, *Saginaw Bay, *Simulation analysis, *Water quality, Drainage basins, Runoff, Phytoplankton, Great Lakes, Equations, Systems analysis, Sensitivity analysis, Mass balance.

Described is modeling research to develop quantitative tools which can be used to supplement intuition and scientific judgment in policy decisions concerning water quality. Quality problems concerning the international waters of the Great Lakes and the application of modeling techniques to Saginaw Bay are considered. Problems are categorized into a series of time and space scales. The series ranges from the short-term transport of some hazardous material within a very localized area to the long-term effects of control or limitation of nutrients or toxic materials within the drainage basins on the ecosystem of individual lakes or of the whole system of lakes. This paper attempts to integrate these different approaches. Applied are transport models and algal growth modeling concepts to Saginaw Bay to describe its prevailing conditions. The simulation model developed is based on available data on the bay, and the modeling concepts will be verified by using an extensive set of field data collected from a sampling design aimed specifically at this modeling program. This modeling system will be used to evaluate the response of the system to a range of management alternatives for enhancing water quality. (See also W79-06166) (BellGraf-Cornell)
W79-06182

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

MODE OF ELEMENTAL DISSIPATION FROM ASH BASIN EFFLUENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W79-06265

DESIGN MODEL FOR THERMAL EFFLUENTS IN RIVERS,
Italian Electrical Power Agency, Pisa. Thermal and Nuclear Research Centre.
G. Dinelli, and L. Castellano.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14422, p 197-211, March 1979. 8 fig, 20 ref, 2 append.

Descriptors: *Thermal pollution, *Rivers, *Model studies, Mathematical models, Numerical analysis, Effluents, Water pollution, Powerplants, Eddies, Buoyancy, Temperature, Water temperature, Diffusion, Turbulence, Velocity, Viscosity, Path of pollutants, Hydraulics.

A quasi three-dimensional mathematical model describing the thermal impact of warm water discharges in rivers was presented. The governing equations were obtained integrating along the depth the complete set of the Navier-Stokes equations with Leibniz's rule and assuming that buoy-

ancy forces are negligible. After the analytical integration was performed, in the mass, momentum and energy equations, terms appeared that make it possible to account for the effects of the actual geometry of the river's cross section and bottom. The eddy viscosity and thermal diffusivity were taken into account by adopting an algebraic model of turbulence based upon the Prandtl mixing length theory. The numerical model, obtained with a finite difference method, provided the spatial, time-dependent distributions of the velocity and temperature fields. The model's results were satisfactorily checked against field data in the case of thermal discharges into fast moving rivers. (Sims-ISWS)
W79-06267

TRENDS IN SEDIMENTATION,
Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2J.
W79-06319

ARSENIC, NITRATE, IRON, AND HARDNESS IN GROUND WATER, FAIRBANKS AREA, ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
P. Johnson, D. E. Wilcox, W. D. Morgan, J. Merto, and R. McFadden.
Geological Survey open-file report 78-1034, 1978. 2 sheets, 14 ref.

Descriptors: *Water quality, *Groundwater, *Iron, *Hardness(Water), *Water wells, Water analysis, Chemical analysis, Water pollution, Public health, Maps, Alaska, Fairbanks area.

Well water with concentrations of arsenic and nitrate exceeding U.S. Environmental Protection Agency standards occurs sporadically throughout the hills north of Fairbanks, Alaska. The arsenic contamination has not been correlated with placer or other mining activity. The high levels of nitrate do not generally appear related to septic waste contamination. Few wells in the Fairbanks area yield water with low concentrations of iron or low hardness. Iron concentrations are consistently greater than 3 mg/L on the flood plain. In the uplands, concentrations of both iron and hardness are lowest near the ridgetops and increase downslope. The report includes a map of the area showing the location of sampled wells and a table of chemical analysis. (Woodard-USGS)
W79-06320

ASSESSMENT OF NONPOINT SOURCES AREAWIDE WASTE TREATMENT MANAGEMENT PLAN FOR THE GREATER HOUSTON AREA.
Dannenbaum Engineering Corp., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 736, Price codes: A17 in paper copy, A01 in microfiche. 1977. 399 p, 18 fig, 57 tab, 120 ref, 2 append.

Descriptors: *Water pollution sources, Texas, Cities, *Urban runoff, *Septic tanks, Water quality, Seepage, *Construction, Dredging, *Biochemical oxygen demand, Mathematical models, Coliforms, Industrial wastes, Pesticides, Oil, Suspended solids.

The nonpoint sources of water pollution within the Greater Houston 208 Planning Area are assessed. Water pollution resulting from urban runoff, septic tank seepages, agricultural runoff, construction site runoff, dredging, and benthal oxygen demand is considered. An analysis of 108 runoff events in several areas of the country, indicated a strong correlation between the log of the cumulative runoff volume and the log of the cumulative pollutant load. Using regression analysis, a stormwater quality-quality model was developed. When septic tank seepages were studied, the Sims Bayou Basin had the greatest pollution impact of septic tanks based on theoretical calculations. Fecal coliforms and BOD were used as septic seepage indicators. The effects of agriculture, injection wells, shipping, oil field waste disposal, and salt water intrusion on water quality were investigated. Mineral and organic suspended sediment in air and water as a result of contruction activities, was emphasized. Other pollutants considered included pesticides, nutrients, solid wastes, construction chemicals, petroleum products, and sanitary wastes. Finally, benthal oxygen demand was a significant sink of dissolved oxygen in the area, particularly in the Houston Ship Channel. (Small-FIRL)
W79-06344

ASSESSING NON-POINT SOURCE POLLUTION. A DETAILED STUDY OF A RURAL WATERSHED IN THE COASTAL PLAIN OF MARYLAND,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
M. Beane, G. R. Chirlin, D. L. Correll, E. S. Friebele, and M. Faust.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 178, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 59 p, 4 fig, 15 tab, 31 ref, 2 append.

Descriptors: *Surface runoff, *Watersheds(Basins), *Heavy metals, *Nutrients, *Bacteria, *Pesticides, Sediments, Maryland, Water quality, Agricultural runoff, Coliforms, Seasonal, Pastures.

A detailed, non-point source study on a rural watershed in the coastal plain of Maryland is presented as the research has applicability to similar regions of the country. Heavy metals, nutrients, bacteria, and sediment were monitored in surface runoff from the Rhode River. The magnitude of non-point source loading to an estuary from a rural watershed and the impact of this loading on water quality, were determined. Nutrient inputs and outputs were determined for each major land use in the watershed. The average yearly discharge of nitrogen, phosphorus, calcium, and magnesium in runoff was highest for pasture, second highest for cultivated land, and very low for forest. Sediment discharge was highest in summer and increased with volume of discharge. Sixty-eight percent of the fecal coliform bacteria discharged came from pasture, 17% from forest, and 15% from cultivated land. Cultivated land had the highest discharge rate for metals in fall, while in summer, pasture had the highest rate. Fe, Mn, Cr, and possibly Cu, were derived from the soil, while Zn, Pb, and Cd were of man-made origin. Alachlor and atrazine concentrations were monitored. Alachlor did not persist in the soil and only .02% of the amount applied to the land was lost in runoff. Atrazine remained in the soil at significant levels four months after its application. Runoff contained 1.2% of the atrazine. (Small-FIRL)
W79-06353

THE SPREADING, RETENTION AND CLEAN-UP OF OIL SPILLS,
Rhode Island Univ., Kingston. Coll. of Engineering.
M. P. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as HCP/P2756-01, Price codes: A07 in paper copy, A01 in microfiche. Report HCP/P2756-01, 1978. 126 p, 5 fig, 14 tab, 387 ref.

Descriptors: *Oils spills, Oil pollution, Water pollution control, *Barriers, *Biodegradation, *Chemical reactions, *Oceans, Dispersion, Dynamics.

The current state-of-the-art for the spreading-retention and clean-up of oil spills is reviewed with in-depth analysis of specific areas not treated in-depth in the literature. Oil spill statistics, tanker and non-tanker ship-generated pollution, and the spreading and drifting of oil slicks are discussed. Containment devices are described. Recommendations are made for basic analytical and experimental studies in barrier technology including fluid dynamics of oil slicks, surface active chemical agents, fast current barrier studies, barrier dynamics, and potential hazards from the use of barriers. Natural and forced biodegradation, and natural and chemical dispersion of oil into the marin environment, are discussed. Research and develo ment needed to mitagate the environmental impa of oil pollution are discussed including preventiv techniques, containment, clean-up, and dispersio (Small-FIRL)
W79-06367

IMPACT OF A SKI BASIN ON A MOUNTAI WATERSHED, I. BACTERIOLOGICAL WATE QUALITY,
New Mexico Univ., Albuquerque. Dept. of Bio ogy.
For primary bibliographic entry see Field 5A.
W79-06390

IMPACT OF A SKI BASIN ON A MOUNTAI WATERSHED, II. HEAVY METALS,
New Mexico Univ., Albuquerque. Dept. of Bio ogy.
For primary bibliographic entry see Field 5A.
W79-06391

FINITE-ELEMENT ANALYSIS OF TH TRANSPORT OF WATER AND SOLUTES I TILE-DRAINED SOILS,
Department of the Environment, Ottawa (Ontar io). Inland Waters Directorate.
For primary bibliographic entry see Field 2F.
W79-06393

POLLUTION PROFILE OF A RIVER,
Bhabha Atomic Research Centre, Bombay (India) Health Physics Div.
For primary bibliographic entry see Field 5A.
W79-06397

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDI MENTS OF LAKES SUPERIOR AND HURON
Canada Centre for Inland Waters, Burlington (On tario).
A. L. W. Kemp, J. D. H. Williams, R. L. Thomas, and M. L. Gregory.
Water, Air, and Soil Pollution, Vol. 10, No. 4, p 381-402, November 1978. 7 fig, 6 tab, 52 ref.

Descriptors: *Sediments, *Pollutants, *Lake Huron, *Lake Superior, *Great Lakes, Sampling, Chemicals, Organic matter, Metals, Heavy metals, Particle size, Hydrogen ion concentration, Oxidation-reduction potential, Water pollution, Water pollution sources, Path of pollutants, Sedimentation.

The concentrations of organic matter, major elements, and trace elements were determined at 15 core locations in Lakes Superior and Huron. The chemical compositions of the cores were related to sediment particle size, Eh, pH, chronology, and location. Concentrations of Si, Al, Ca, Mg, K, Na, and Ti, which represent the major mineral species in the sediments, were generally uniform in each core. Surface enrichments of Hg, Pb, Zn, Cu, Ni, Co, Cd, Cr, Be, V, As, Org-C, and N at many of the locations were attributed to anthropogenic inputs of these elements in recent years. Concentration profiles of Fe, Mn, P, and S are influenced by migration of these elements in the pore waters. High anthropogenic Cu loadings in Lake Superior were related to Cu mining activities in the lake basin, while high anthropogenic inputs of Ni to the Lake Huron sediments were related to Ni contamination from the Sudbury area. Sediment loading calculations showed that the anthropogenic inputs of trace and nutrient elements are related to the sedimentation rate, that the inputs are dispersed over wide areas of the lakes, and that inputs to Lake Superior have increased significantly since 1955. Evidence was presented that atmospheric inputs are an important source of contaminants. (Sims-ISWS)
W79-06399

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMEN-

TAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Aid, and Soil Pollution, Vol 9, No 4, p 453-465, May 1978. 5 fig, 4 tab, 6 ref.

Descriptors: *Radium, *Leaching, *Soil contamination, *Laboratory tests, *Canada, Radioactivity, Radioactive wastes, Radioactive waste disposal, Acids, Acidity, Acidic water, Hydrogen ion concentration, Soils, Infiltration, Pollutants, Path of pollutants, Groundwater, Water quality, Water pollution, Water pollution sources.

The leachability of Ra-226 from soil at Port Hope, Ontario, contaminated by waste from a long established U refinery was described. A small-scale static leach test was devised to provide information to permit an assessment of hazard due to leaching in the environment. Two different leaching solutions were prepared to simulate a range of infiltrating water quality in disoposal environments: one by bubbling CO2 into distilled water to pH 5.5, and another by bubbling SO2 into water to pH 3.5. Narrow-range size fractions of the soils (i.e., 0.250 to 0.105 mm) were leached for 30 to 45 days (equivalent rainfall of 2 to 3 yr). It was found that leaching is significantly affected by soil texture, total amounts leached and the maximum concentrations reached being much greater for coarser and intermediate size fractions than for fine soil fractions. Also, leachant acidity significantly increased leaching rates and resulted in enhanced mobility in soils. A straight line for the plot of Q/Q sub o (cumulative fraction released) vs square root of T (T is leaching time in days) indicated that leaching could be considered to be a diffusion phenomenon in accordance with Fick's law. Diffusion coefficients ranging from 5 x 10 to the minus 11th power to 2 x 10 to the minus 13th power sq cm/day were found. These coefficients provide a basis for estimating the fraction that would be leached over longer periods. (Sims-ISWS)
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
B. L. Sawhney.
Water, Air, and Soil Pollution, Vol 9, No 4, p 499-505, May 1978. 3 fig, 2 tab, 16 ref.

Descriptors: *Leaching, *Phosphates, *Soil water movement, *Groundwater, Phosphorus, Phosphorus compounds, Soil water, Fertilizers, Sewage sludge, Agriculture, Crops, Pollutants, Path of pollutants, Vegetation effects, Water pollution, Water pollution sources, Water quality.

To examine the fate of P added to soils as fertilizer and to assess potential P losses to groundwater, different forms of P at increasing depths in soils and P concentration in effluents from tile drains were determined. The estimates of soil P showed that the fertilizer P applied over a number of years accumulated mainly in the plow layer, suggesting that P losses to groundwater from cultivated soils with deep water table are minimum. Analyses of effluents obtained over a 1 yr period from tile drains in 4 soils in different crops, however, showed that the concentration of P varied from 12 ppb to 124 ppb. The concentration of P in effluent from the soil with the largest amount of P in the plow layer remained the largest throughout the year. Apparently, in cultivated soils with the tile drains, flooding may produce reducing conditions resulting in greater mobility of P. (Sims-ISWS)
W79-06401

FIELD PROCEDURES AND EVALUATION OF A SLUG DILUTION GAUGING METHOD IN MOUNTAIN STREAMS,
Geological Survey of Canada, Ottawa (Ontario).
T. J. Day.
Journal of Hydrology (New Zealand), Vol 16, No 2, p 113-115, 1977. 8 fig, 8 tab, 20 ref.

Descriptors: *Mixing, *Waste dilution, *Streams, *Tracers, Stream flow, Turbulence, Channels, Mountains, On-site investigations, On-site data collections, Data processing, Equipment, Instrumentation, Sampling, Salts, Sodium chloride, Hydraulics, Hydrology, *New Zealand.

The application of a method (NaCl) of dilution gaging in turbulent mountain streams was evaluated with discussions about equipment, field procedures, mixing lengths, tracer losses, and the precision of derived hydraulic parameters. Mixing lengths were shown to be equal to 25 mean channel widths, and that this length was independent of the cross-sectional position of injection. Tracer losses were described as linear features, although no explanation can be offered. Precision, expressed as percentage probable error about the means of the 4 pertinent hydraulic variables, was discussed, with individual errors ranging from 1 to 21%, median errors ranging from 4.7 to 7.3% and modal errors ranging from 3.6 to 6%. Comments on sampling procedures were offered, and several simplified procedures for estimating the mean velocity and discharge were presented. (Sims-ISWS)
W79-06415

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-06423

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT; VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
For primary bibliographic entry see Field 5A.
W79-06449

GEOLOGICAL FEATURES,
California State Univ., Long Beach.
J. Dennis.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 1, p 1-1 - 1-59, September 1974. 11 fig, 2 tab, 222 ref.

Descriptors: *Baseline studies, *Hazards, *Geologic history, Resources development, Water pollution sources, Seismology, Earthquakes, Oil, *Outer Continental Shelf, Natural seeps, Tars.

Basic current knowledge of the geology in the Southern California coastal Zone and the offshore continental borderland is summarized and a guide to the relevant literature is provided. Southern California geology is complicated because large displacements along faults have subdivided the crust here into a number of morphotectonic segments or blocks whose mutual geologic relationships are still, in large measure, controversial. In the area under consideration, earthquake risk is greatest along the coast, diminishing seaward. Oil and tar, as well as gas seeps, are associated with the Los Angeles basin and its extension offshore. They do not extend south of Huntington Beach. Seeps are usually transient phenomena. Their exact source on the sea floor is very difficult to determine. Commonly, they occur as groups of small individual seeps concentrated in a restricted area where a structural trap has been tapped by erosion. They may be activated or reactivated by tectonic or seismic movement. Unstable slopes and cliffs are very characteristic of the coastal zone under consideration. A brief summary of slope evolution in late Pleistocene and Recent time is given. Subsidence has occurred in the area under consideration where fluids have been withdrawn from underlying rocks. This includes both groundwater and oil. Such subsidence can be prevented by controlled water injection during oil withdrawal. (See also W79-06449) (Sinha-OEIS)
W79-06450

CHEMICAL OCEANOGRAPHY,
California State Univ., Long Beach.
K. M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 4-1 - 4-81, September 1974. 26 fig, 10 tab, 91 ref.

Descriptors: *Baseline studies, *Water pollution sources, *Chemistry, *Pollutant identification, *Water chemistry, *Water quality, Resources development, Environmental effects, Dispersion, Models, Waste, *Outer Continental Shelf, *Southern California Bight, Outfalls, Natural seeps.

The major water mass off Southern California is the California Current, which is an eastern boundary current of a large anticyclonic gyre in the Eastern North Pacific Ocean. The water carried southward by the California Current is low temperature, low salinity, but high dissolved oxygen content subarctic water. In the study area, the water is primarily from the Counter Current and the properties of the water will vary depending on the degree of mixing of the above current and water, and the extent of modification as a result of heating and cooling, dilution, evaporation, biological activity and, towards the coastal area, waste discharges. In the study area the main input of biologically oxidizable organic matter is from municipal waste dischargers. The trace metals input to the study area are classified as diffused and discrete sources. Their distribution pattern by area is summarized and their characteristics are discussed. The diffused sources in the study area include ocean dumping, aerial fallout, vessel waste and advective transport. The presence of the residues of polychlorinated biphenyls (PCB), and DDT compounds are widespread. Marine organisms caught from the waters off Southern California consistently contain higher concentrations of DDT residues than in those areas receiving extensive agricultural drainages. Oily substances in the marine environment may be derived from oil production, industrial wastes, municipal waste, spill during transportation, and accidents. The non-anthropogenic source of oil is probably from submarine seeps. (See also W79-06449) (Sinha-OEIS)
W79-06453

HYDROGRAPHY OF HARBORS, LAGOONS AND SLOUGHS,
California State Univ., Fullerton.
N. J. Maloney, and K. M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 5-1 - 5-66, September 1974. 29 fig, 9 tab, 65 ref.

Descriptors: *Baseline studies, *Hydrography, *Water resources, Lagoons, Harbors, *Water pollution sources, Geomorphology, Coasts, Tides, Waste disposal, Water pollution, Resources development, Environmental effects, *Outer Continental Shelf, *Flushing, Southern California Bight, Sloughs.

The project area includes 18 lagoons and harbors that fall into the following general categories: (1) Salt marsh lagoons, (2) man-made small boat harbors, (3) man-made deep water harbors, (4) continental shelves protected by breakwaters, (5) estuaries of intermittent streams. Man has physically altered these bodies of water by construction for industrial, recreational, and residential purposes; and chemically altered the water by adding pollutants of various types. The larger embayments remain open to the ocean and receive tidal flushing. Seasonal storm run-off, power plant coolant water, and sewage outfalls increase the flushing rate. The health of a bay depends upon the relationship between the pollutant inflow and the flushing. The small lagoons are cut off from the ocean by barrier spits for long periods of time. They do not receive tidal flushing and may revert to fresh or hypersaline water depending on the local run-off conditions. These lagoons are highly vulnerable to pollution because they are not diluted by tidal action. (See also W79-06449) (Sinha-OEIS)
W79-06454

POLLUTION SOURCES,
California State Univ., Long Beach.
W. H. Reed, and T. P. Bakker.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 6-1 - 6-99, September 1974. 30 fig, 30 tab, 102 ref.

Descriptors: *California, *Water pollution sources, *Baseline studies, *Pollutants, Waste disposal, Heavy metals, Thermal pollution, Resources development, Environmental effects, Chlorinated hydrocarbon pesticides, *Outer Continental Shelf, Southern California Bight, Ocean dumping.

That portion of the Southern California Bight covered by this study and the tributary area bounded on the north, east and south by the Transverse and Peninsular ranges and the U.S. Mexican border are inter-related by several varied and/or extreme geographic-oceanographic-geomorphic, climatic and demographic conditions. The introduction of pollutants into the marine environment can occur as discharges from municipal waste water treatment plants, industrial plants, electrical generating stations, and water-borne vessels. Additionally, pollutants can enter the marine environment as surface runoff, aerial fallout, flaking and dissolution of antifouling vessel paints, and direct ocean dumping from barges and other vessels. Substances introduced include sewage sludge, waste water treated only to remove floatable and suspended solids, garbage, chlorine, phosphates and nitrates, heated water, chlorinated hydrocarbons and heavy metals. It should be noted that over one-half the population (nearly 11 million people) of the State of California reside in these portions of Los Angeles and San Diego Counties that contribute to the pollution of the area. This is over 5% of the U.S. population. (See also W79-06449) (Sinha-OEIS)
W79-06455

PHYTOPLANKTON,
California State Polytechnic Univ., Pomona.
R. Z. Riznyk.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 2, p 7-1 - 7-33, September 1974. 8 fig, 2 tab, 106 ref.

Descriptors: *Baseline studies, *Phytoplankton, *Ecosystems, *Water pollution sources, Environmental effects, Toxins, Red tide, Waste disposal, Sewage disposal, Resources development, *Outer Continental Shelf, Southern California Bight.

The importance of phytoplankton in the ecology of Southern California coastal and offshore areas involves three major aspects: (1) Their productive nature is of paramount importance as the base of the food chain and any change in their abundance or community structure will invariably affect subsequent portions of the chain. (2) Excessive enrichment or eutrophication of local areas may result in the phytoplankton bloom which can discolor the water, produce noxious odors, cause fish kills, make shellfish unfit for human consumption and interfere with the recreational potential of an area. (3) Their uptake of toxic materials which may enter the food chain is of utmost importance to the seafood industry and the welfare of man. Most ecological research has been with regard to the effect of sewage outfalls on species composition, standing stock and productivity. Generally it has been noted that production and standing stock is highest in outfall areas than in control areas. No change in species composition has been noticed. No relationship has been established between the red tide and sewage outfalls. (See also W79-06449) (Sinha-OEIS)
W79-06456

ZOOPLANKTON,
California Univ., Irvine.
For primary bibliographic entry see Field 5C.
W79-06457

BENTHIC ALGAE AND GRASSES,
California State Univ., Fullerton.
S. N. Murray.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 9-1 - 9-61, September 1974. 2 fig, 10 tab, 146 ref.

Descriptors: *Benthos, *Algae, *Grasses, *Baseline studies, Ecology, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Southern California Bight.

A summation and evaluation of published studies concerned with marine benthic algae and grasses of southern California is provided. Literature included in this report has been largely confined to that collected directly within the circumscribed area, although attempts have been made to include additional relevant material where appropriate. The great majority of the literature discussed has been concerned with macro-algae (Chlorophyta, Phaeophyta and Rhodophyta) and grasses (Spermatophyta) collectively referred to as macrophytes. Relatively little information exists on micro-algal components of the marine benthos, e.g., Cyanophyta (blue-green algae), benthic Bacillariophyta (diatoms) and benthic Chrysophyta (chrysophytes), for the southern California region as well as worldwide. The contents of this report have been organized under the topics of taxonomy, ecology and economic resources. (See also W79-06449) (Sinha-OEIS)
W79-06458

RECOMMENDATIONS FOR BASELINE RESEARCH IN CENTRAL AND NORTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06464

SEA-FLOOR INSTABILITY OF CONTINENTAL SHELF OFFSHORE CENTRAL AND NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
For primary bibliographic entry see Field 2J.
W79-06465

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

POLLUTING INCIDENTS IN AND AROUND U.S. WATERS, CALENDAR YEAR 1977.
Coast Guard, Washington, DC.
For primary bibliographic entry see Field 5C.
W79-06476

5C. Effects Of Pollution

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
For primary bibliographic entry see Field 5A.
W79-06007

QUALITY ASSURANCE PROGRAM FOR TRACE HYDROCARBON ANALYSIS,
National Bureau of Standards, Washington, DC. Analytical Chemistry Div.
For primary bibliographic entry see Field 5A.
W79-06021

TRANSPORT MECHANISMS AND HYDROCARBON ADSORPTION PROPERTIES OF SUSPENDED MATTER IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, J. D. Cline, and G. J. Massoth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VII Contaminant Baselines, p 11-72, October 1978. 2 fig, 5 tab, 38 ref. NOAA, Outer Continental She Environmental Assessment Program, Boulde Colorado.

Descriptors: *Bottom sediments, *Suspended loa *Oil pollution, *Circulation, *Estuaries, Enviro mental effects, Baseline studies, Resources deve opment, Water resources, Alaska, *Outer Cont nental Shelf, *Cook Inlet, Crude oil, Estuarin processes.

The seasonal distributions and elemental composi tion of suspended particulate matter in Lowe Cook Inlet were studied and compared with cur rent patterns and bottom sediment distributions. I general, the suspended matter distributions appea to follow the pattern of circulation in Lower Coo Inlet and Shelikof Strait. Comparisons of physica characteristics of suspended matter and sediment from the central basin indicates that net sedimenta tion of the fine grained suspended particles is mini mal. However, sedimentation may be occurring i the numerous embayments along the coast. Chemi cal analysis of the particulate matter reveals tha fine grained aluminosilicate minerals comprise about 80-95% of the suspended matter with bio genic material making up the rest. Analysis o seasonal variations of the C:N ratio of the particu late organic matter indicates that organic matter o marine origin is dominant in summer whereas ter restrially derived organic material predominates i winter when productivity is low. Laboratory ex periments involving the interactions between Cook Inlet crude oil and suspended matter from Lower Cook Inlet show that the accommodation capacity of suspended matter for crude oil increases with the concentration of added oil. Important parameters in the accommodation process include: the chemical nature and viscosity of the oil; the mineralogical and size characteristics of the particulate matter; temperature; and degree of mixing. (Sinha-OEIS)
W79-06022

IDENTIFICATION OF NATURAL AND ANTHROPOGENIC PETROLEUM SOURCES IN THE ALASKAN SHELF AREAS UTILIZING LOW MOLECULAR WEIGHT HYDROCARBONS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W79-06023

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5B.
W79-06024

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. G. Shaw, P. Else, R. Gritz, G. Malinky, and G. Mapes.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 495-588, October 1978. 6 fig, 11 tab, append. 03-5-022-56.

Descriptors: *Baseline studies, *Water pollution sources, *Oil pollution, *Sediments, Environmental effects, Resources development, Alaska, Distribution, *Outer Continental Shelf, *Hydrocarbons, *Aromatic hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons.

Work completed in the study of the distribution and dynamics of hydrocarbons on the Alaskan outer continental shelf is reported. A striking finding is the observation that sediments from the Beaufort Sea and from Cook Inlet contain suites of

aromatic hydrocarbons. The data indicate that the sources of these hydrocarbons are multiple and complex. It appears that anthropogenic pyrolysis may be a contributing source. This is the first hint that the Alaskan marine environment may not be generally pristine. A preliminary statistical treatment of multiple determinations of hydrocarbons in sediment is reported. Although this treatment is not complete, important conclusions can be reached about the relationship of present analytical variability to natural environmental variability. A study of the interactions of hydrocarbons with suspended sediments of Southcentral Alaska is presented in detail. Quantitative information about this process, which has been the subject of considerable speculation, is presented. (Sinha-OEIS)
W79-06025

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM LOWER COOK INLET,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 5B.
W79-06026

ON THE PEROXODISULPHATE OXIDATION OF TOTAL NITROGEN IN WATERS TO NITRATE,
Uppsala Univ. (Sweden). Dept. of Analytical Chemicstry.
F. Nydahl.
Water Research, Vol 12, No 12, p 1123-1130, 1978. 8 tab, 10 ref.

Descriptors: *Nitrate, *Nitrogen, *Oxidation, *Measurement, *Analytical techniques, *Methodology, Nutrients, Degradation(Decomposition), Koroleff method, Alkalinity, Water temperatures, Nitrites, Dyes, Cadmium, Hydrogen ion concentration, Reagents, Chemistry, Digestion.

An improved experimental basis is presented for the oxidation-process method of determining total nitrogen in natural waters (the standard methodology in use by the Scandinavian countries). Following a discussion of the proper concentrations of peroxodisulfate and sodium hydroxide for digestion and the proper pH and buffer system for reduction, a new reagent is proposed whose concentrations of peroxodisulfate and sodium hydroxide are founded on stoichiometric relations at the autodecomposition of the peroxodisulfate; the proper pH of 8.0 for reduction is achieved by adding the calculated amount of Tris (hydroxymethyl) aminomethane hydrochloride. A method is given for preparing potassium peroxodisulfate of a very low nitrogen blank. Digestion is performed at 100 or 120C. Requisite digestion time, a function of the autodecomposition of the peroxodisulfate, was 90 min at 100C, or 15 min at 120C. Yields obtained by oxidation of various nitrogen compounds were similar at both temperatures, but were dependent on the form of the nitrogen linkage. Accuracy of the method is dependent on the nature of the nitrogen compounds and their concentrations; a negative error of 0-8% seems probable. (Lynch-Wisconsin)
W79-06030

FACTORS AFFECTING PHOSPHATE ABSORPTION EQUILIBRIA IN LAKE SEDIMENTS,
Dufresne-Henry Engineering Corp., North Springfield, VT.
W. C. Ku, F. A. DiGiano, and T. H. Feng.
Water Research, Vol 12, No 12, p 1069-1074, 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Phosphates, *Absorption, *Equilibrium, *Lakes, *Sediments, *Cycling nutrients, Massachusetts, Lake Warner(MA), Lake Wyola(MA), Nutrients, Phosphorus, Model studies, Langmuir model, Mathematical models, Water pollution sources, Interstitial water, Eutrophication, Mesotrophy, Hydrogen ion concentration, Water temperature, Aluminum, Iron, Calcium, Chemistry, Oxidation-reduction potential.

A comparative laboratory study of phosphate absorption in noncalcareous sediments from Lakes Wyola and Warner, Massachusetts (16 km apart and connected by the Mill River) showed both aluminum and iron to be important binding metals, but sediment phosphate absorption in highly eutrophic Lake Warner was more controlled by iron, and in mesotrophic Lake Wyola more by aluminum. The Langmuir absorption model was used to describe quantitatively effects of redox, pH, and temperature on sediment equilibria. The model mathematically describes experimental data, and is compatible with a possible mechanism of phosphate binding. The difference between the sediments was evident from the less-diminished sorptive potential shown by Lake Wyola sediment under anaerobic conditions, and reinforced by comparison of absorption before and after oxalate extraction. A difference in phosphate binding was also seen in differences in pH dependency of absorption by the two sediments. Absorption isotherms at 11 and 20C also indicated a significant decrease in the exothermicity of the reactions at lower pH, suggesting that more than one mechanism is operative in the pH range of 5.5-7.0. Overlying water in Lake Wyola generally had a phosphate concentration of < 20 microg/l throughout the year, and interstitial phosphorus was 100 microg/l. In Lake Warner phosphate reached 9-100 microg/l in summer, decreasing to 60-80 microg/l in winter; interstitial phosphorus ranged from 400-600 microg/l. (Lynch-Wisconsin)
W79-06032

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W79-06071

RADIATIVE PROPERTY MEASUREMENTS FOR SELECTED WATER SUSPENSIONS,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
For primary bibliographic entry see Field 5A.
W79-06075

STUDY OF SULFATE PULP MILL EFFLUENT TOXICITY (ESTUDIO DE LA TOXICIDAD DE LOS EFLUENTES DE UNA FABRICA DE PASTA AL SULFATO),
A. P. Ribot, and A. T. Lopez.
Investigacion y Tecnica del Papel, Vol. 15, No. 57, p 742-754, July, 1978. 40 ref.

Descriptors: *Reviews, *Pulp wastes, *Toxicity, *Water pollution effects, Wastes, Kraft mills, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Fish, Invertebrates, Oxygen, Fungicides, Detergents, Bactericides, Waste water treatment.

This literature review covers the effects of kraft pulp mill effluents on fish and invertebrates, role of oxygen in the toxicity of such effluents, elimination of toxic substances, measurement of effluent toxicity, and other mill agents causing environmental problems (fungicides, bactericides, detergents, etc.). (Speckhard-IPC)
W79-06128

GENERAL ASPECTS OF WATER POLLUTION BY THE PULP AND PAPER INDUSTRY (ASPECTOS GENERALES DE LA CONTAMINACION DEL AGUA POR LA INDUSTRIA DE PULPA Y PAPEL),
I. Acosta-Contreras.
Instituto Forestal Latino-Americano, Merida, Venezuela, Boletin No. 52, p 27-54, 1977. 28 ref, 9 tab. English Summary.

Descriptors: *Pulp and paper industry, *Water pollution, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Air pollution, Solid wastes, Water quality, Water analysis, Waste water treatment, Waste treatment, Legislation, United States, Canada, Foreign countries, Japan, Sweden, France, Economic impact, Water pollution control, Water pollution effects.

A review is presented of the influence of pulp and paper production on the environment (water pollution, air pollution, pollution by solid wastes, indirect pollution); the relationship between water quality and industrial processes (wood preparation, mechanical pulping, neutral sulfite semichemical pulping, sulfite pulping, sulfate pulping, pulp screening, washing, cleaning, and bleaching, paper machine operations, and finishing and converting); analysis of water pollution by the pulp and paper industry; methods for reducing water pollution (primary, secondary, and tertiary treatment within the mill, treatment outside the mill); legislation relating to the reduction of water pollution in the U.S.A., Canada, Japan, Sweden, and France; and the economic impact of water pollution control on the pulp and paper industry. (Speckhard-IPC)
W79-06130

COMPARISON OF SOME TOXICITY INDICATORS IN A STUDY OF THE EFFECT OF PULP AND PAPER INDUSTRY EFFLUENTS ON PONTOGAMMARUS ROBUSTOIDES (GRIMM) (SRAVNENIE NEKOTORYKH POKAZATELEI TOKSICHNOSTI PRI IZVCHENII VLIYANIYA STOCHNYKH VOD TSELLYULOZNOBUMAZHNOI PROMYSHLENNOSTI NA BOKOPLAVOV PONTOGAMMARUS ROBUSTOIDES (GRIMM)),
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. Zoologii i Parazitologii.
I. B. Gazdzyauskaite.
Eksperimental'naya Vodnaya Toksikologiya, Vol. 6, p 105-110, 1976. 3 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Water pollution effects, *Crayfish, *Toxicity, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Aquatic animals, Alcohols, Yeast, Bleaching wastes, Water pollution.

The crayfish Pontogammarus robustoides (Amphipoda) was used to test the toxicity of effluents from two pulp and paper mills, including a mixed effluent from sulfite liquor preparation, pulp chlorination, bleach plant, and residual liquor from ethanol and yeast production; an overall effluent from pulp manufacture; and a paper mill effluent. All effluents were toxic. The mixed effluent was the most toxic. Paper mill effluent was the least toxic. The effects of pollutants included growth inhibition, reduced feed consumption, reduced respiration rate, and cannibalism. The most sensitive indicator was the hatching rate which decreased sharply at relatively low effluent concentrations (0.58% mixed effluent and 2.9% paper mill effluent). (Stapinski-IPC)
W79-06132

COMPLEMENTARITY OF THERMOREGULATORY RHYTHMS IN MICROPTERUS SOLMOIDES AND M. DOLOMIEUI,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Hydrobiologia, Vol. 60, No. 1, p 89-91, 1978, 1 fig, 14 ref.

Descriptors: *Environmental effects, *Temperature, Bass, Fish behavior, Niches, Photoperiodism, Thermoregulation, Preferred temperature.

Largemouth and smallmouth black basses were tested in an electronic thermoregulatory shuttle box, which permits a fish to control water temperatures by its movements between chambers monitored by photo cells, to determine temperature preference. With a LD 12:12 photoperiod, it was found that smallmouth bass had a preferred temperature peak of 30.1C during the latter portion of the photophase while largemouth bass were reaching a minimum of 27.1C. Smallmouth bass reached a minimum of 26.6C during the latter part of scotophase while largemouth bass reached a peak of 29.5C during mid-scotophase. The two species are sympatric over much of their ranges. It was concluded that the thermotemporal comple-

mentarity of the rhythms shown in this study suggest a possible mechanism which, in conjunction with differing light intensity preferences, could aid in segregating their respective niches. (Chilton-ORNL)
W79-06163

MATHEMATICAL MODELING OF EUTROPHICATION PROCESSES IN LAKE ONTARIO,
Manhattan Coll., NY. Dept. of Environmental Engineering and Science.
R. V. Thomann.
In: American-Soviet Symposium on Use of Mathematical models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 208-242 (Discussion p 243-245), September 1978. 18 fig, 2 tab, 23 ref. EPA-600/9-78-024.

Descriptors: *Eutrophication, *Lake Ontario, *Model studies, *Great Lakes, *Water quality, *Phytoplankton, *Kinetics, Effects, Large lakes, Environmental control, Nutrient removal programs, Biological response, Conservation of mass, Model verification, Death rate, Net production, Circulation, Chlorophyll, Hypolimnetic recycling, Biological recycling, Nutrients, *Simulation analysis, Estimating, Systems analysis, Equations.

This research structures a mathematical modling framework of the major features of eutrophication in large lakes. Lake Ontario, the subject of intensive field work as part of the International Field Year for the Great Lakes, is used as the problem setting. The overall objectives of the research include: (1) determination of important interactions in lake eutrophication; (2) analysis of lake water quality and biological response to natural and man-made inputs; and (3) formation of a basis for estimating the direction of change to be expected under remedial environmental control actions. The problems of impairment of the quality of lake systems are magnified for 'large lakes' such as the Great Lakes. Their size precludes any immediate improvement in quality after control actions are taken; it is much more difficult to obtain reliable data on water quality biological structure and hydrodynamic circulation due to sampling difficulty. The general circulation may not be adequately known in relation to climatological and hydrological factors. Measures of phytoplankton populations are temporarily and spatially dependent and reflect complex interactions with nutrients, such as nitrogen and phosphorus, and upper trophic level predation. This report reviews works accomplished to date on development of a mathematical model of phytoplankton in Lake Ontario that hopefully will form a reasonable basis for estimating the effects of nutrient removal programs. (See also W79-06166) (Bell Graf-Cornell)
W79-06175

MODELING THE DISPERSION OF POLLUTION AND THERMAL POLLUTATION IN WATER BODIES,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Hydrodynamics.
O. F. Vasilyev.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 246-260 (Discussion p 261-262), September 1978. 4 fig, 11 ref. EPA-600/9-78-024.

Descriptors: *Water bodies, *Model studies, *Dispersion, *Water pollution, *Thermal pollution, Hydraulic flow, Probability density, Pollutant concentration, Hydrothermal processes, Diffusion, Laplace's function, Equations, Systems analysis, Numerical analysis.

The problem of water pollution caused by discharge of agricultural, industrial, and municipal effluents containing various pollutants is very real. In some cases, pollution can be linked with the discharge of heated water. Evaluation of the degree of influence of a pollution source on the water environment requires an evaluation of the resultant hydrodynamic and physical process, as well as the chemical-biological processes of self-purification. Mathematical models of water quality have been developed to describe these processes. They are based on the application of hydrodynamic equations of turbulent liquid motion and include equations that describe the mass balance of miscellaneous pollutants as well as heat and oxygen. The major hydrodynamic question is the definition of diffusion coefficients when compiling these equations. A survey has been taken of eight reports which studied separate aspects of the common problem of water pollution. The reports may be conditionally subdivided into three groups; this survey report is accordingly divided into the following three sections: (1) flow in water bodies; (2) hydrothermal processes in water bodies; and (3) convective diffusion. Special attention is given to numerical modeling of these phenomena in shallow water bodies. (See also W79-06166) (Bell Graf-Cornell)
W79-06176

DESCRIPTIVE SIMULATION MODEL FOR FORECASTING THE CONDITION OF A WATER ECOSYSTEM,
Scientific Research Institute of Engineering and Applied Mathematics, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5A.
W79-06183

HF SURFACE-CURRENT MAPPING RADAR 1977 ALASKAN OPERATIONS--LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
For primary bibliographic entry see Field 7B.
W79-06187

OBSERVATIONS OF SURFACE TIDAL COMPONENTS IN LOWER COOK INLET USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
A. S. Frisch, and B. L. Weber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Trransport, p 21-39, October 1978. 9 fig, 5 ref. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado.

Descriptors: Tidal effects, *Oil spills, Radar, *Baseline studies, *Ocean currents, Coasts, Estuaries, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Tidal currents, Oil transport, Cook Inlet.

The use of two HF radars for tidal surface current studies appears especially useful for looking at the spatial variability in complex coastal and estuarine areas. With limited data we have been able to see spatial effects in the 12 and 24 hour phase and amplitude of the tides. Examples are given. (Sinha - OEIS)
W79-06188

CURRENT MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Aagaard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport. p 40-60, October 1978. 9 fig, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Ocean currents, *Oil spills, *Ocean circulation, Path of pollutants, Baseline studies, Water pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Beaufort Sea, Current measurements, Oil transport.

The picture which emerges from the work done on the outer shelf to date is of a regime that is quite energetic over a broad band of sub-tidal frequencies. The mean flow calculated for a sufficiently long period (possibly up to several months) is unquestionably eastward. The flow appears to be steered by the local bathymetry. Although the energetic time scales of the flow are those of synoptic meteorological events, no clear relationship between atmospheric and oceanic events has been shown to date, even in a phenomenological fashion. The implication with respect to the subsurface transport of pollutants and other substances on the outer shelf is that (1) in the mean they will move significant distances eastward along the shelf, and (2) trajectory prognosis would be meaningless at the present level of understanding. (Sinha-OEIS)
W79-06189

GULF OF ALASKA SHELF CIRCULATION,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Schumacher, R. Charnell, S. Hayes, H. Mofjeld, and R. Muench.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 61-213, October 1978. 54 fig, 8 tab, 55 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RP0000R7120847.

Descriptors: *Ocean currents, *Ocean circulation, *Baseline studies, *Hazards, Oil spills, Water pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Gulf of Alaska, *Oil transport, Petroleum development.

Field investigations, begun in Autumn 1974, have and continue to provide data which aids our understanding of hydrographic, current and pressure regimes in the Gulf of Alaska. Many important features have been identified, including: the relation between bottom pressure and velocity; cross-shelf coherence; gyral circulation west of Kayak Island; the pronounced effect of the Alaskan Current inflow through Shelikof Strait; the presence of shelf edge waters in the nearshore regions of troughs; and, a description of flow in Lower Cook Inlet. Further work, primarily intensive data analysis, will focus on understanding these and similar features, and estimating their importance in assessing hazards related to petroleum development. (Sinha - OEIS)
W79-06190

ALASKA NUMERICAL MODELING,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Galt, J. Overland, R. Stewart, C. Pease, and M. Hitchman.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 214-326, October 1978. 31 fig, 10 tab, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120845.

Descriptors: *Mathematical models, *Ocean currents, *Meteorology, *Circulation, Baseline studies, Wind(Meteorology), Environmental effects, Alaska, Oil spills, *Outer Continental Shelf, Oil transport, Northeast Gulf of Alaska(NEGOA).

Numerical modeling of oceanographic and meteorological regimes provides an aide to the understanding of currents and winds in the Gulf of Alaska. Many important components have been developed, including: a diagnostic model for the prediction of surface currents, a regional meteorological model for the prediction of surface winds, and methodologies for simulating the temporal and spatial variations in the velocity fields. Later this

year field data will be interpreted and these parts integrated to give estimates of pollutant trajectories for the region with particular emphasis on NEGOA. The report presents a careful evaluation of the diagnostic model with a formalized approach to the boundary conditions and a restructuring of the model equations. Data sets are identified for applying the diagnostic model to NEGOA. The results of a one dimensional calculation with the regional meteorological model for NEGOA and a system for extrapolating the results to develop typical coastal wind fields are discussed. Results of two methods for arriving at a set of pressure maps which provide a good coverage of the climatology for the Gulf of Alaska are presented. Trajectory model development and schemes for incorporating field data and results from other models into trajectory calculations through an environmental disk system are also discussed. Future work is outlined with the discussion of the current progress on each individual task. (Sinha-OEIS)
W79-06191

BRISTOL BAY OCEANOGRAPHIC PROCESSES (B-BOP),
Washington Univ., Seattle. Dept. of Oceanography.
L. K. Coachman, T. H. Kinder, J. D. Schumacher, and R. L. Charnell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 327-575, October 1978. numerous fig, tab, ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. R7120840.

Descriptors: *Hydrography, *Ocean currents, *Tides, *Hazards, Baseline studies, Oil spills, Water pollution effects, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Bristol Bay, Oil transport, Petroleum development.

Field investigations, begun in Autumn 1975, are now beginning to bear fruit and our understanding of the hydrographic and current regimes in Bristol Bay is growing. Many interesting and important features have been identified, including fine structure, fronts, anomalously diminished tidal currents, and an eddy. Further work, primarily requiring intensive data analysis, will focus on understanding these and similar features, and estimating their importance in assessing hazards of petroleum development. (Sinha-OEIS)
W79-06192

STD MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Aagaard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 575-590, October 1978. 8 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Water pollution, *Path of pollutants, *Dispersion, Salinity, Temperature, Density, Freezing, Baseline studies, Environmental effects, Arctic Ocean, Resources development, Alaska, *Outer Continental Shelf, *Pollutant transport, Beaufort Sea.

Results of the study include: (1) the direct influence of freezing extends far below the local pycnocline, due to the differential movement of waters from a variety of locations seeking their density level; (2) there are considerable year-to-year differences in hydrography and anomalies can persist through several seasons; (3) it seems likely that in the mean there is a net flow of saline water onto the shelf in the lower part of the water column; and (4) the temperature signal of the Bering Sea water is largely erased within a month or two after freeze-up. The major implication of the STD work with respect to the transport and dispersal of pollutants is that at least the outer part of the shelf, e.g., that portion deeper than about 50 m, is an active area even after freeze-up. There is ample evidence both of large-scale motion along the shelf, and of cross-shelf flux and exchange with the Arctic Ocean to the north. (Sinha-OEIS)
W79-06193

LAGRANGIAN SURFACE CURRENT MEASUREMENTS ON THE OUTER CONTINENTAL SHELF,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. V. Hansen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 590-603, October 1978. 7 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Currents(Water), *Circulation, *Path of pollutants, *Oil spills, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, *Surface currents, *Oil transport, Trajectories, Gulf of Alaska, Bering Sea, Lagrangian current data.

The objectives of this work unit are to obtain Lagrangian current data for assessment of probable trajectories of oil spills in the Gulf of Alaska and the S.E. Bering Sea using drogued free drifting buoys located several times daily by a satellite positioning system. During the 1977 field season six buoys were deployed S.E. of the Pribilof Islands in the S.E. Bering Sea. These deployments were as successful as those of 1976. The longest surviving buoy has recently terminated transmission after nearly 7 1/2 months of successful operation since May 1977. An average buoy lifetime in excess of 135 days was achieved during this year. It is believed that most of the buoys failed after being caught in the ice at the end of the field year. One buoy grounded on St. George Island less than two months after deployment, and another grounded on St. Paul Island about six months after deployment. Overall, more than 820 days of surface current data were obtained in the region 54 - 59 degrees N, 163 - 178 degrees W. A principal early conclusion that can be drawn is that surface currents in the S.E. Bering Sea are characterized by extensive eddying with several day average current speeds on the order of 20 cm/sec or less. Sustained current speeds of greater than 30 cm/sec are rarely seen, at least during Summer and Fall. The net displacement of water from the region is even more sluggish. Typical long term displacements are on the order of 400 km in 100 days. (Sinha-OEIS)
W79-06194

STUDY OF CLIMATIC EFFECTS ON FAST ICE EXTENT AND ITS SEASONAL DECAY ALONG THE BEAUFORT-CHUKCHI COASTS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
R. G. Barry.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 604-708, October 1978. 5 fig, 3 tab, 14 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-91.

Descriptors: *Sea ice, *Seasonal, *Baseline studies, Oil pollution, Resources development, Environmental effects, Water pollution, Alaska, Path of pollutants, *Outer Continental Shelf, *Fast ice, *Climatic effects, Beaufort Sea, Chukchi Sea, Petroleum development, Oil transport.

Nearshore ice along Alaska's Beaufort Sea and Chukchi Sea costs undergoes an annual cycle of formation, extension, modification, ablation, and breakup. Many of the processes which contribute to this cycle are poorly understod, although it is generally recognized that meteorological and climatological factors are important influences for ice formation, motion, deformation, ablation, and breakup. This study is attempting to interpret ice characteristics and their time variations from remote sensing data supplemented by aircraft and field observations. This derived information covering both the Beaufort and Chukchi coasts is then compared with concurrent coastal weather conditions and regional atmospheric pressure patterns. Offshore petroleum development may involve temporary operations on the winter fast-ice surface or in the open waters during summer. Alternately, large, ice-resistant structures may be used year-round. An accurate assessment of the best operational modes and of the seasonal distribution of ice hazards requires that the normal patterns and variabilities of fast-ice characteristics and breakup processes be specified. Also, the pathways of pollutants deriving from oil spills or blowouts are dependent to some degree on the season, and, in summer, on relative progression of the breakup. It also seems significant that various faunal populations utilize the coastal environment, above and below the ice and in open water areas. Seasonal and interannual variations in the weather and ice characteristics are important factors affecting the distribution and movements of these populations. (Sinha-OEIS)
W79-06195

A METEOROLOGICAL BASIS FOR LONG-RANGE FORECASTING OF SUMMER AND EARLY AUTUMN SEA ICE CONDITIONS IN THE BEAUFORT SEA,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
J. C. Rogers.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 709-719, October 1978. 2 fig, 6 tab, 8 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Forecasting, *Sea ice, *Meteorology, Baseline studies, Oil spills, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, *Oil transport, Petroleum development, Beaufort Sea, Long-range forecasting.

The beginning of drilling operations and the movement of supplies and resources between Point Barrow and Prudhoe Bay, Alaska, has made an assessment of the Beaufort Sea ice regime imperative. The Beaufort Sea is ice covered approximately nine months of the year. Only between late July and early October (in favorable ice summers) is it possible to safely ship supplies along the coast. In more severe ice summers such as those of 1955 and 1975 shipping can be delayed or halted. The overall results of the study suggest that persistence of monthly air temperature anomalies at Barrow in conjunction with cautious application of periodicities in those temperatures can be successfully used as predictors of the severity or mildness of summertime Beaufort Sea ice conditions. Depending upon user needs these meteorologically based prediction techniques could feasibly used in other aspects of sea ice forecasting, particularly the time of freezeup. (Sinha-OEIS)
W79-06196

MECHANICS OF ORIGIN OF PRESSURE RIDGES, SHEAR RIDGES AND HUMMOCK FIELDS IN LANDFAST ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, H. F. Bates, and W. D. Harrison.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 720-760, October 1978. 8 fig, 12 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Offshore platforms, *Hazards, *Resources development, Baseline studies, Water pollution, Oil spills, Environmental effects, *Outer Continental Shelf, *Landfast ice, Petroleum development.

All three phases of this project are directly relevant to the design of offshore structures for OCS

development and to the safe conduct of related operations. Potential override by the ice sheet is a recognized hazard in all phases of exploration and development in the offshore area of the Beaufort Sea coast, and the state of the ice during the break-up period makes this a particularly hazardous time. Attempts have been made by industry to develop sensors which can be used to provide early warning of impending ice motion in the vicinity of a structure. The study of ice vibrations in progress under this project may prove to be a relatively simple and inexpensive method for accomplishing this. The results of two studies related to the association of the long period vibrations with high compressive stresses are presented. In addition, a series of measurements of the coefficients of both static and kinetic friction between ice and beach gravel were made, and these results have been used to calculate the stresses involved in driving the ice sheet up the beach at Barrow in July 1975. The results of these calculations are comparable to the forces required to form the ridges along the beach. The latter forces were calculated from a modified version of the kinematic model of pressure ridging and these results are also given. (Sinha-OEIS)
W79-06197

MORPHOLOGY OF BEAUFORT, CHUKCHI AND BERING SEAS NEAR SHORE ICE CONDITIONS BY MEANS OF SATELLITE AND AERIAL REMOTE SENSING,
Alaska Univ., Fairbanks. Geophysical Inst.
W. J. Stringer, S. A. Barrett, and L. Schreurs.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 1-220, October 1978. 102 fig, 16 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Hazards, *Offshore platforms, *Oil pollution, Baseline studies, Resources development, Environmental effects, Alaska, Coasts, Remote sensing, *Outer Continental Shelf, *Petroleum development, Shore ice, Chukchi Sea, Beaufort Sea, Bering Sea.

Based on the combined seasonal morphologies, a zonal analysis of potential hazards related to offshore petroleum development has been made for the Chukchi and Beaufort seas. The hazards addressed are: safety of field personnel performing offshore geologic reconnaissance, large-scale displacement or deformation of fast ice sheet, the probability of formation of large ice ridge systems which could bring large forces to bear on offshore structures, and the possible fate of an under-ice oil spill. The general conclusion is that near shore sea ice behavioral patterns are similar from year to year thereby yielding some predictability in terms of offshore sea ice hazards to oil and gas development. The implications are that geographical zones of different design and construction criteria can be established in the offshore areas taking into consideration the probability of damage to the structure by adverse ice conditions and the relative risk imposed to the adjacent ecosystems. (Sinha-OEIS)
W79-06198

DEVELOPMENT OF HARDWARE AND PROCEDURES FOR IN-SITU MEASUREMENT OF CREEP IN SEA ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, and E. R. Hoskins.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 221-259, October, 1978. 16 fig, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Hazards, *Offshore platforms, *On-site tests, *Resources development, Baseline studies, Pollution, Water pollution, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum development.

Any permanent or semi-permanent structure located off the Arctic Coast of Alaska must content with the hazard that sea ice presents to its stability. The extent of this hazard depends on three basic parameters. First, the strength of the structure itself, with respect to its ability to withstand forces of a given magnitude. Second, the geometry of the interaction between the structure and the surrounding ice, including the state of bonding between the two and, finally, the strength of the ice, which determines the maximum force that the ice can sustain in the mode of failure which the structure is designed to induce. The first two of these parameters are determined largely by the third, the strength of the ice, and it is to this problem that the project is directed. A field program is currently in progress in which it is intended to test about 100 samples of ice with dimensions of 30 x 30 x 60 cm in uniaxial compression. Tests are being conducted at constant load to examine creep and creep-rupture behavior, and at constant loading rates to determine the strength. The methods used and results to date are described. (Sinha-OEIS)
W79-06199

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 7B.
W79-06200

CIRCULATION AND WATER MASSES IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. T. Royer.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 292-323, October 1978. 4 fig, 1 tab, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Circulation, *Water masses, *Baseline studies, *Path of pollutants, Resources development, Pollution, Environmental effects, *Outer Continental Shelf, *Oil transport, Petroleum development, Gulf of Alaska.

The most important result of this year's research is the separation of precipitation and wind stress effects on the coastal dynamic height, and hence the coastal circulation. There is evidence of eddies and other perturbations in the circulation that are both temporary and permanent. The wind stress effects the circulation, but the exact mechanism or magnitude is not known. Besides the discovery of the precipitation effect, the shelf circulation appears to consist of a coastal current and a shelf break current with weak flow between them. There is some evidence for baroclinic flow into Prince William Sound. There is also evidence that fresh water runoff affects the transport in the Alaska Stream and that maybe this is a boundary between the coastal waters and oceanic waters. We have found that the geostrophic currents, as determined from CTD/STD measurements, correspond to results of the drifters. (Sinha-OEIS)
W79-06201

NEAR-SHORE METEOROLOGY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. M. Reynolds.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 324-568, October 1978. 4 fig, 2 tab, 5 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120848.

Descriptors: *Winds, *Currents, *Oil spills, *Path of pollutants, Resources development, Baseline studies, Environmental effects, Alaska, *Outer Continental Shelf, Cook Inlet, Wind effects, Near shore meteorology, Petroleum development.

This study concentrates on the Lower Cook Inlet region which is the most vulnerable to industrial development. Research into the oceanic circulations in this enclosed region, reveals a chaotic unpredictable pattern, to a large extent controlled by the wind stress history over the water. This ability of the wind to control the current field, especially the near surface currents, coupled with the direct frictional coupling of the wind to the surface oil, confirms the importance of a knowledge of the wind field. Knowledge of the predictability of the winds in various regions is important for any shipping, platform service operations or aircraft operations, not to mention oil spill trajectory prediction. Thus, any areas which do not yield to existing forecast procedures, must be delineated. Either new forecasting techniques need to be developed, or direct telemeterins measurements must be made to properly specify the winds in these regions. The results of research thus far are summarized in five appendices to this report. (Sinha-OEIS)
W79-06202

MODELING OF TIDES AND CIRCULATIONS OF THE BERING SEA,
Rand Corp., Santa Monica, CA.
J. J. Leendertse, and S. Liu.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 569-579, October 1978. 18 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35249.

Descriptors: *Models, *Tides, *Circulation, Meteorology, Baseline studies, Resources development, Path of pollutants, Environmental effects, Alaska, *Outer Continental Shelf, Bering Sea, Petroleum development.

In the graphical system, the facility for vertical plots is extended to all variables. Computed time histories at selected depths up to six series can now be plotted on a single frame. To reduce compiling and storage costs, the graphic system consists of a fixed and a variable part, thus improving the efficiency of the storage usage. Computational subroutines in the program are independent of the model's dimensions and need not be recompiled for each case. A graphical system for analyzing tidal constituents in the modeled area determined from the computed water level data by means of Fourier transformation for each frequency considered in the model are being developed. (Sinha-OEIS)
W79-06203

COASTAL METEOROLOGY OF THE ALASKAN ARCTIC COAST,
Washington Univ., Seattle. Div. of Marine Resources.
E. Leavitt.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 580-606, October 1978. 15 fig, 3 tab, 12 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Winds, *Meteorology, *Oil spills, Baseline studies, Resources development, Water pollution, Environmental effects, Alaska, *Outer Continental Shelf, *Oil trajectories, Petroleum development.

Given the strong correlation between winds measured at wide separations along the coast, it would be possible to provide winds for predicting coastal current trajectories with only a few measurement points. This would be more accurate than calculating the surface wind from the geostrophic wind; especially given the possibility of mesoscale phenomena such as the sea breeze and the necessity for simultaneously measuring boundary layer stratification. However, this must be qualified if winds are required further than 20 or 30 km offshore or inland from the coast. The relative ease with which pressure sensor equipped data buoys can be

set out on the ice, or for that matter inland from the coast, suggest their use in the latter case. The wind measurements along the coast could then serve as input to the calculation of surface winds from the pressure field. Such a combination of wind and pressure measurement stations could be set up and maintained for a relatively small expenditure, providing an excellent data base for studies of current (or oil spill) trajectories. (Sinha-OEIS)
W79-06204

CHARACTERIZATION OF THE NEARSHORE HYDRODYNAMICS OF AN ARCTIC BARRIER ISLAND - LAGOON SYSTEM,
Alaska Univ., Fairbanks. Geophysical Inst.
J. B. Matthews.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 607-627, October 1978. 7 fig, 16 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colo. 03-5-022-56.

Descriptors: *Hydrodynamics, *Food chains, *Circulation, *Baseline studies, *Water pollution effects, Arctic Ocean, Water temperature, Salinity, Turbulence, Food chains, Resources development, Environmental effects, Alaska, Obstruction to flow, *Outer Continental Shelf, *Nearshore processes, Petroleum development.

Physical circulation and processes occurring in the nearshore regions of the Beaufort Sea have a primary influence on the biological processes. Currents and water temperature, salinity and turbulence have a direct effect on organisms at the base of the food chain. These in turn affect the higher organisms such as fish and birds which are vulnerable to oil related impacts along the Alaskan north slope coast. The system is primarily driven in the open water season by meteorological events, water from the rivers appears to stay nearshore and move in a generally westward direction. Causeways and other solid structures appear to modify the longshore flow. Flushing times during strong winds and storms could be of the order of a few days and surface drifters reached Point Barrow from Purdhoe Bay in less than a week. Implications for oil and gas developments are that, during the open water season, spilled oil could be distributed over the whole coastline in about one week if it coincided with the frequent storm conditions. Preliminary results suggest that islands, causeways and other obstructions to longshore flow need to be designed with consideration for allowing free passage of the brackish river waters near the mainland shores. (Sinha-OEIS)
W79-06205

SEDIMENT CHARACTERISTICS, STABILITY, AND ORIGIN OF THE BARRIER ISLAND-LAGOON COMPLEX, NORTH ARCTIC ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
A. S. Naidu.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 628-686, October 1978. 6 fig, 9 tab, 21 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Exploitation, *Ecosystems, *Barrier islands, *Lagoons, *Environmental effects, Resources development, Baseline studies, Sediments, Oil spills, Alaska, *Outer Continental Shelf, North Slope, Beaufort Sea, Petroleum development.

The sedimentological studies are part of a larger interdisciplinary research effort to study the physicochemical and biological processes operative in the barrier island-lagoon ecosystem. It also entails establishment of an ecosystem model which can be put to use in predicting possible impacts resulting from both petroleum exploration and exploitation activities in the barrier island-lagoon complex of the Beaufort Sea coast. As a consequence of the OCS petroleum and gas development activities, the nearshore and the open shelf ecosystem of the Beaufort Sea is bound to be subjected to some degree of anthropogenic perturbations. The industrial activities which most likely will be introduced in this area include the construction of artificial islands and causeways for the use of drilling operations and docking facilities, dredging for maintaining navigation, and the exploitation of gravel and sand deposits from several possible sources as construction and fill materials. Already significant changes in the size distributions, benthic and chemical attributes of bottom sediments, as well as on the nearshore bathymetry have been recognized in the vicinity of Prudhoe Bay, consequent to the building of the new ARCO causeway. If the response of the physical environment and biological resources of the area to such changes can be properly assessed, or even predicted, it is quite possible that effective measures can be developed to protect or enhance existing resources. (Sinha-OEIS)
W79-06206

THE ENVIRONMENTAL GEOLOGY AND GEOMORPHOLOGY OF THE BARRIER ISLAND - LAGOON SYSTEM ALONG THE BEAUFORT SEA COASTAL PLAIN FROM PRUDHOE BAY TO THE COLVILLE RIVER,
Alaska Univ., Fairbanks. Dept. of Geology.
P. J. Cannon, S. E. Rawlinson, M. G. Moore, and J. Reuben.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 687-731, October 1978. 6 fig, 5 tab, 5 map. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Geomorphology, *Detritus, *Baseline studies, Environmental effects, Barrier Islands, Lagoons, Resources development, Alaska, *Outer Continental Shelf, Environmental geology, Beaufort Sea, Petroleum development.

The purpose is to provide quantitative and qualitative data for assessing the environmental impact of development within the Simpson Lagoon area. Before environmental impact assessment is possible, however, past and present natural processes and conditions of the barrier island-lagoon system must be determined. Specific modeling requirements from the geomorphology subgroup are the volume and mass of detrital material introduced into Simpson Lagoon by shoreline erosion and from fluvial injection. Natural geological conditions and processes are best indicated by the individual landforms and/or the landform assemblages of the area. Recognition of these landforms and knowledge of the geomorphic processes by which they formed, enables the prediction of future changes, both natural and man-induced. Results of this investigation to date are presented in this report. (Sinha-OEIS)
W79-06207

OCEANOGRAPHIC PROCESSES IN A BEAUFORT SEA BARRIER ISLAND-LAGOON SYSTEM: NUMERICAL MODELING AND CURRENT MEASUREMENTS,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. C. H. Mungall, R. W. Hann, Jr., D. J. Horne, R. E. Whitaker, and C. E. Abel.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 732-830, October 1978. 20 fig, 1 tab, 6 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-7-022-35182.

Descriptors: *Currents, *Barrier islands, *Lagoons, *Models, *Winds, *Resources development, Environmental effects, Baseline studies, Water pollution, Drilling, Oil pollution, Alaska, *Outer Continental Shelf, Beaufort Sea, Transport model, Petroleum development.

Simpson Lagoon, the principal study area and considered a typical example of an arctic barrier island lagoon system, lies some 10 miles to the west of Prudhoe Bay. The region will be subject to development should exploratory drilling occur offshore in the wake of the initial success of the Prudhoe Bay oilfield. One of the most likely points of impact will be the barrier islands, since they constitute convenient locations for offshore drilling. The modeling part of the investigation concentrated around the development of a two-dimensional vertically-integrated transport model and a three-dimensional multi-level model--both having the same 1 km x 2 km grid spacing and the same bottom topography. Findings from the modeling are that exchange rates and currents vary primarily with the angle between the wind and the lagoon axis (regardless of whether the wind is westerly or easterly) and of course with wind speed. Any discussion of the implications of these preliminary findings on OCS oil and gas development would be premature at this time, since any such implications are primarily related to possible biological impacts. (Sinha-OEIS)
W79-06208

DEVELOPMENT AND OPERATION OF A REMOTE SENSING DATA ACQUISITION PLATFORM FOR OCS STUDIES,
Naval Arctic Research Lab., Barrow, AK.
For primary bibliographic entry see Field 7B.
W79-06209

OIL SPILL VULNERABILITY OF THE BEAUFORT SEA COAST,
South Carolina Univ., Columbia. Dept. of Geology.
D. Nummedal, I. A. Fischer, and J. S. Knoth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 853-859, October 1978. 2 fig, 2 tab, 7 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Geomorphology, *Barrier islands, *Oil spills, *Sediment transport, *Path of pollutants, Baseline studies, Environmental effects, Resources development, Water pollution, Alaska, *Outer Continental Shelf, *Oil transport, Beaufort Sea.

Project objectives were to characterize the morphology of the barrier islands and the mainland shoreline and to assess the retention potential for spilled hydrocarbons within the coastal environment. Measurements of littoral process variables along the mainland and island shores of the Beaufort Coast of Alaska are much too sparse to permit an evaluation of the spatial and temporal variations of beach sediment transport. Data presented in this report, however, are suggestive of a typical annual net transport rate of about 100,000 cubic meters to the west along the seaward beaches of the Beaufort barriers. The rate of longshore movement of coarse-grained beach material (sand and gravel) is found to range from essentially zero up to 4100 cubic meters per day. (Sinha-OEIS)
W79-06210

NORTON SOUND/CHUKCHI SEA OCEANOGRAPHIC PROCESSES (N-COP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. D. Schumacher, R. D. Muench, T. H. Kinder, L. K. Coachman, and R. L. Charnell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 860-928, October 1978. 25 fig, 1 tab, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120840.

Descriptors: *Hydrography, *Tides, *Currents, *Water pollution, Baseline studies, Resources development, Environmental effects, Oil pollution, Alaska, *Outer Continental Shelf, *Oil transport, Petroleum development.

The general objective was to relate oceanic advective and diffusive processes to potential pollution problems due to OCS petroleum development. Net flow through Bering Strait was northward throughout the winter of 1976-77 based upon records from moored current meters in Bering Strait and southeast of St. Lawrence Island. There was an overall factor of 2 decrease in kinetic energy density of northern Bering Sea currents at the time of ice formation, as recorded by the overwinter current meters. Tidal currents were extremely complex in the northern Bering Sea and Norton Sound regions. A mixed tide southeast of St. Lawrence Island gave way to a primarily diurnal tide in Norton Sound off Nome. In Bering Strait, there was no diurnal tidal signal and the semidiurnal signal was extremely small. Two summer hydrographic surveys of Norton Sound revealed a pronounced two-layered structure: a cold, saline near-bottom layer was overlain by a warmer, lower salinity upper layer. The lower layer, a remnant of the preceding winter's convective regime (surface cooling and ice formation) persisted throughout the summer. The overall distribution of temperature and salinity suggested a sluggish horizontal circulation in the eastern sound with a weak cyclonic circulation in the western portion; circulation was weaker in the lower than in the upper layer, and was negligible in the lower layer in the eastern sound. (Sinha-OEIS)
W79-06211

THE INTERACTION OF OIL WITH SEA ICE IN THE ARCTIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.
S. Martin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 8-10, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Sea ice, *Hazards, *Oil spills, *Baseline studies, Laboratory tests, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Grease ice, Pancake ice, Oil transport.

The major laboratory effort is to develop a model for oil entrainment in grease and pancake ice; forms of ice which are important in the lee shore regions of Norton and Kotzebue Sound. Also, the laboratory pancake work is a rough model of how oil might spread in a field of larger floes. The work suggests that oil will collect in the grease ice at the point of transition from a liquid to a solid. In lease areas such as Norton and Kotzebue Sound, satellite photographs show that the grease ice forms in long larrow Langmuir-like plumes parallel to the wind. These plumes absorb the energy of the bi-directional wind-wave field. It is suspected from the experiments that oil spilled in these areas will be driven into the Langmuir plumes by the circulation, and collect in bands parallel to the grease ice. (Sinha-OEIS)
W79-06212

DYNAMICS OF NEAR-SHORE ICE,
Army Terrestrial Sciences Center, Hanover, NH.
A. Kovacs, and W. Weeks.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 11-22, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-1651.

Descriptors: *Sea ice, *Dynamics, *Hazards, *Engineering, Offshore platforms, Baseline studies, Resources development, Environmental effects, Water pollution, *Outer Continental Shelf, Fast ice, Nearshore ice, Petroleum development.

A knowledge of motion, deformation and physical characteristics of both the near-shore pack ice and the fast ice is essential to adequately designing and estimating the hazards associated with a variety of engineering options that may be considered for offshore operations in the near coastal areas of the Beaufort and Chukchi Seas. This program contributed directly to the solution of this general class of engineering problems in that it provides much of the geophysical and engineering data upon which sound engineering and regulatory decisions can be made. Detailed quantitative information on the movement and deformation of both the near-shore pack of ice and the fast ice along the coast of the Beaufort Sea has been obtained. Studies have also been carried out on the nature of the ridge systems located near the edge of the fast ice, on lateral variations in the thickness of first and multiyear ice, and on the internal structure of sea ice. The Narwhal Island area that is being studied is a portion of a coming lease sale, possesses favorable geologic structures and is a natural extension of the known Prudhoe Bay field. Basic information is provided by the remote sensing program on the distribution of ice types and features and in particular ridges that will be required as one aspect of a risk analysis for the construction of an offshore drilling platform sited on the edge of the Arctic Ocean. (Sinha-OEIS)
W79-06213

DYNAMICS OF NEAR SHORE ICE,
Washington Univ., Seattle. Polar Science Center.
R. S. Pritchard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 39-49, October 1978. 1 fig, 1 tab. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. 03-50-022-67.

Descriptors: *Sea ice, *Ice cover, *Path of pollutants, Oil spills, Resources development, Baseline studies, Environmental effects, Water pollution, Alaska, *Outer Continental Shelf, *Ice motion, *Oil transport, Chukchi Sea, Beaufort Sea, Petroleum development, Near shore ice.

Chukchi Sea ice motions are presented from March to September 1977, and the deployment of additional buoys in March 1978 is discussed. Observations of ice motions are relevant to problems of petroleum development for two broad reasons: (1) the ice cover will serve as a carrier of any petroleum products spilled in either the Beaufort or Chukchi Sea so that ice trajectories serve as the first estimate of the paths to be taken by the oil; and (2) the ice motion is an observable quantity that may be compared with simulated values to test the performance of an ice dynamics model which in turn may be used to determine a range of ice motions in a variety of environmental conditions. The ice motion data in the Chukchi Sea (both area wide and over the continental shelf) is particularly important because of its proximity to the Bering Sea which is a rich ecosystem that must be protected from pollution because of its high biological productivity. (Sinha - OEIS)
W79-06214

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W79-06215

OFFSHORE PERMAFROST STUDIES, BEAUFORT SEA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2C.
W79-06216

MARINE ENVIRONMENTAL PROBLEMS IN THE ICE COVERED BEAUFORT SEA SHELF AND COASTAL REGIONS,
Geological Survey, Menlo Park, CA. Pacific-Arctic Branch of Marine Geology.
P. Barnes, and E. Reimnitz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 148-299, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RK6-6074.

Descriptors: *Sea ice, *Hazards, *Permafrost, *Pipelines, *Drilling, Baseline studies, Resources development, Environmental effects, Oil pollution, Pollution, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The marine geology and modern sedimentary environment off arctic Alaska is studied with emphasis on rates and processes and in particular the phenomena involving ice and its unique influence on the shelf and inshore environment. The character of the arctic continental shelf and coastal area, with its year round and seasonal sea ice and with it permafrost, faces the developer with many special problems. The interaction of the arctic shelf with the arctic pack ice takes the form of ice gouging and the formation of a large stamukhi zone each winter. Oil drilling and production during the next several years will probably not extend into the stamukhi zone seaward of the seasonal fast-ice zone. Of critical concern are the ice gouge and strudel scour effects on structures and pipelines. A similar emphasis has been taken by the Canadian Beaufort Sea Project in their more advanced state of knowledge and readiness to lease their outer continental shelf lands. The offshore drilling operation may encounter permafrost which could be substantially altered during the process of pumping hot oil up to the sea floor or along the sea floor in gathering and transportation pipelines. (Sinha-OEIS)
W79-06217

DISTRIBUTIONS OF GRAIN SIZE, TOTAL CARBON, HEAVY AND LIGHT MINERALS, CLAY MINERALOGY, AND INORGANIC GEOCHEMISTRY, OUTER CONTINENTAL SHELF, SOUTHERN BERING SEA,
Geological Survey, Menlo Park, CA.
J. V. Gardner, T. L. Vallier, W. E. Dean, K. A. Kvenvolden, and G. D. Redden.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 300-383, October 1978. 32 fig, 7 tab, 30 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RK6-6074.

Descriptors: *Sediment distribution, *Geochemistry, *Baseline studies, *Hazards, Minerals, Carbon, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Bering Sea, St. George Basin, Petroleum development.

The U.S. Geological Survey and BLM initiated a cooperative program to evaluate potential geologic hazards on the outer continental shelf area of the southern Bering Sea. The principle objectives of this study are to describe the distribution and types of surface sediment, and the processes effecting these distributions. The region covered in this study centers on the St. George Basin and covers an area bounded by the Aleutian Islands and Alaska Peninsula on the southeast, the shelf break at a depth of about 170 m on the southwest, the Pribilof Islands on the north and the 100 m isobath on the northeast. The present-day continental shelf of the southern Bering Sea is extremely flat and broad. Bottom gradients typically are much less than 0.25 degrees (1:13,000) and the large rivers that feed sediment into the Bering Sea, the Yukon, Kuskokwim, Kvichak, and to a lesser extent the Nushagak Rivers, are all over 500 km away from the St. George Basin area. Sediment is transported from these rivers into Bristol Bay but has almost no opportunity to be advected to the St. George Basin area because of the extremely low topographic gradient and insufficient watermass movement. Consequently it is believed that sediments are not presently being deposited on the outer continental shelf of the southern Bering Sea. This implies that all of the surface sediments are relict and that the sediments are Late Quaternary. (Sinha-OEIS)
W79-06218

'UKON DELTA COASTAL PROCESSES 'TUDY,
Houston Univ., TX. Dept. of Geology.
V. R. Dupre.
n: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 384-446, October 1978. 19 fig, 2 tab, 44 ef. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Coasts, *Hazards, *Ice, *Geomorphology, Oil spills, Permafrost, Environmental effects, Baseline studies, Resources development, Sediment transport, Alaska, *Outer Continental Shelf, *Coastal processes, Yukon Delta, Petroleum development.

The Yukon delta is strongly influenced by the effects of ice in the ground, on the river, and offshore. Several of the major depositional environments of the Yukon delta appear to be restricted to ice-dominated coastlines. Similarly, the seasonality of coastal processes is dominated by the effects of ice throughout much of the year, thus a careful study of this region may provide insights into sedimentary processes and geologic hazards in other ice-dominated coastal zones as well. The siting of offshore facilities must take into account the mobility and deformation of seasonal pack ice, the extent and variability of shorefast ice, the probability of offshore permafrost, and the possible effects of altering offshore bathymetry in changing coastal stability. In addition, the evaluation of possible oil spills must take into account not only the dominant northward drift of water and suspended sediments, and the local and seasonal variability of current patterns, but also the role of sub-ice channels in affecting bedload transport. The selection of shoreline sites must take into account the present coastal stability, including the possibility of erosion associated with major storm surges. The effects of shorefast ice over half of the year must also be considered as well as the heterogeneity of the shoreline in determining oil spill vulnerability. (Sinha-OEIS)
W79-06219

EARTHQUAKE ACTIVITY AND GROUND SHAKING IN AND ALONG THE EASTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA. Office of Earthquake Studies.
C. Stephens, K. A. Fogleman, and J. C. Lahr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 447-474, October 1978. 9 fig, 20 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Earthquakes, *Baseline studies, Resources development, Environmental effects, Alaska, Oil spills, *Outer Continental Shelf, Gulf of Alaska, Petroleum development, Ground shaking.

The objective of this research is to evaluate the hazards associated with earthquake activity in the eastern Gulf of Alaska and adjacent onshore areas. These hazards may pose a threat to the safety of petroleum development. The current seismicity does not necessarily reflect the locations of large historical earthquakes. Large temporal variations in the rate of seismic activity have also been observed. Continued seismic monitoring will no doubt reveal other areas of activity and delineate other active geologic structures. Three earthquakes which occurred at the turn of the last century resulted in uplift of up to 14 meters between Cape Yakutaga and Yakutat Bay. Another onshore earthquake such as one of these or a great earthquake associated with low-angle oblique underthrusting of the sea floor beneath the continental shelf would be accompanied by strong ground shaking throughout much of the eastern Gulf of Alaska, possibly from Cross Sound to Kayak Island, and could trigger tsunamis, seiches, and submarine slumping, any of which could be hazardous to offshore and coastal structures. (Sinha-OEIS)
W79-06220

SEISMIC AND VOLCANIC RISK STUDIES -- WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
H. Pulpan, and J. Kienle.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 475-570, October 1978. 15 fig, 5 tab, 6 ref, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Earthquakes, *Volcanoes, *Hazards, Alaska, Baseline studies, Resources development, Environmental effects, Oil pollution, *Outer Continental Shelf, *Gulf of Alaska, Petroleum development.

This research was designed to determine the seismicity of the lower Cook Inlet, Kodiak Island, and the Alaska Peninsula and to evaluate the seismic risk to onshore and offshore development. Annual service, routine maintenance, and operation of the regional seismic network of 25 seismic stations constituted the largest portion of the field and laboratory activities. A fairly comprehensive assessment of the hazard associated with Augustine Volcano is provided, based upon both historical data and detailed studies in connection with the 1976 eruption. A similar, preliminary assessment is provided for the volcanic risk associated with Redoubt Volcano. (Sinha-OEIS)
W79-06221

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W79-06222

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W79-06223

BENTHOS - SEDIMENTARY SUBSTRATE INTERACTIONS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
C. M. Hoskin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XII, Hazards, p 1-43, October 1978. 32 fig, 5 tab, 8 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Benthos, *Bottom sediments, Distribution, Water pollution, Baseline studies, Environmental effects, Resources development, Alaska, Particle size, *Outer Continental Shelf, Bering Sea, Petroleum development.

The main objective of the Bering Sea work was to determine relationships between the grain size mode of bottom sediment and distribution and abundance of the macrobenthos. Largest total number of individuals on a unit area basis occurred for stations having grain size modes of fine sand with smaller numbers of individuals at stations having coarser or finer sediment. Lowest total wet weight per square meter was found in these fine sand sediments, with larger weights of macrobenthos tending to occur at stations with coarser or finer sediment. It appears that the larger number of small individuals at fine sand stations is the result of current action. Particle size is only one of many parameters that control the distribution and abundance of benthic organisms. Careful consideration should be given to obtaining data for total organic carbon and the main components - protein, carbohydrate and lipid, to aid in characterizing the quality of organic carbon as food for the benthos. (Sinha-OEIS)
W79-06224

SHALLOW FAULTING, BOTTOM INSTABILITY, AND MOVEMENT OF SEDIMENTS IN LOWER COOK INLET AND WESTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA.
M. A. Hampton, and A. H. Bouma.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 44-187, October 1978. 11 fig, 11 tab, 9 ref, 8 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sediment transport, *Path of pollutants, *Tectonics, *Faults(Geologic), *Hazards, Baseline studies, Resources development, Environment effects, Water pollution, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

Environmental geologic investigations in Lower Cook Inlet and the western Gulf of Alaska were continued in 1977 with seismic profiling, side scan sonar, bottom sampling and underwater TV and camera the prime activities. Based on the 1976 reconnaissance study certain geologic phenomena were concentrated on that may pose a problem to development and need detailed studies before conclusions can be drawn. On the Kodiak shelf, the principal geo-environmental concerns are related to sediment distribution and movement, and to the structural-tectonic setting. Objectives, based on this premise, have been to determine sediment dispersal patterns across the shelf, to enable prediction of pollutant transport routes and storage sites, and to study the movement history of seafloor faults to determine which ones have recently been active and which have not. (Sinha-OEIS)
W79-06225

FAULTING, SEDIMENT INSTABILITY, EROSION, AND DEPOSITION HAZARDS OF THE NORTON BASIN SEA FLOOR,
Geological Survey, Menlo Park, CA.
H. Nelson, and D. E. Thor.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 187-307, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Faults(Geologic), *Sediment transport, *Gases, *Deposition, Storm surge, Currents(Water), Erosion, Path of pollutants, Water pollution, Resources development, Environmental effects, Ice, Alaska, *Outer Continental Shelf, *Bering Strait, Thermogenic gas, Biogenic gas, Petroleum development, Ice gouge.

Environmental evaluation of geologic phenomena in northern Bering Sea indicates faulting, ice gouging, bottom currents, storm surges, and gas-charged sediment pose potential problems to development of offshore resources. Potentially unstable near-surface sediment results from apparent thermogenic gas charging in a local area 40 km south of Nome and from a wide region of biogenic gas charging in north central Norton Sound. Geophysical, geotechnical, and geochemical evidence indicate that hydrocarbon gases of subsurface, thermogenic origin apparently migrate into the near-surface sediment along fault zones 30-40 km south of Nome. Gas migration from the subsurface accumulation to the surface sediment is indicated by smaller zones of reflector terminations observed in high-resolution profiles and more rapid penetration of the vibracorer in sediment at sites of surface acoustic anomalies. Any artificial structures penetrating the apparent large gas accumulation at 100 m or associated faults with gas-charged sediment may provide direct avenues for uncontrolled gas migration to the sea floor. Such structures also may encounter reduced bearing capacity in this gas-charged substrate. Present knowledge suggests that the offshore region surrounding the Yukon Delta and eastern Bering Strait areas have the combination of the most severe geologic hazards. Faulting and current scour are most intense near Bering Strait. Ice gouge, bottom-current scour and

storm surge activity are all intense over a wide area around the shallow prodelta area. Apparent gas cratering occurs throughout north central Norton Sound. (Sinha-OEIS)
W79-06226

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
D. A. Cacchione, and D. E. Drake.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 308-450, October 1978. 27 fig, 3 tab, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Path of pollutants, *Sediment transport, *Resources development, Oil spills, Baseline studies, Environmental effects, Alaska, *Outer Continental Shelf, *Oil transport, Bering Sea, Norton Sound, Petroleum development.

A multi-faceted investigation of sediment dynamics in Norton Sound and other sections of the Northern Bering Sea was conducted to define the principal pathways and mechanisms of bottom and suspended materials transport during the past two years. This research is extremely pertinent to two major impact areas of petroleum development in the marine environment: transport of materials including pollutants; and hazardous sea floor conditions produced by erosion caused by currents and waves. Oil that is absorbed by the fine suspended organic and inorganic material and that is mixed into the bottom sediments will be transported by the regional mean currents. The higher frequency currents such as tidal flow and surface wave-induced currents add local complications to the transport effects. The ability to predict accurately the movements of pollutants in the sea is strongly dependent on our knowledge of local transport processes. Specific geographic regions, like Norton Sound, will have unique aspects to the mechanisms which control the paths and amounts of material that is moved. It can now be demonstrated that storms play a major part in the transport of sediment in Norton Sound. Preliminary results show that ice transport of sediment may be highly significant in the Norton Sound area. (Sinha-OEIS)
W79-06227

COASTAL PROCESSES AND MORPHOLOGY OF THE BERING SEA COAST OF ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W79-06228

SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W79-06229

SEISMOTECTONIC STUDIES OF NORTHEAST AND WESTERN ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
N. N. Biswas, and L. Gedney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 575-619, October 1978. 10 fig, 5 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Hazards, *Earthquakes, *Structural engineering, Seismic studies, Exploration, Deformation, Oil pollution, Resources development, Baseline studies, Environmental effects, Alaska, Pipelines, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Hydrocarbons, Icequakes.

The analysis of the seismic data gathered to date shows that, on the eastern part of Beaufort Sea shelf, the area north of Barter Island is subject to earthquakes in the magnitude range of from 5 to 6. During the exploration and development phases of the proven hydrocarbon reserves in this area, one of the design criteria for structures should be to withstand ground vibrations corresponding to those from a shallow earthquake (less than 20 km) of at least magnitude 6.0. Linear structures, like pipelines, used for transportation of oil or gas through the eastern part of the Brooks Range and the Chandalar and Yukon River basins should take into account the possibility of ground dislocations, perhaps by a significant amount over a period of time, at points of major mapped fault crossings. In the western part of Alaska, around the Seward Peninsula, analysis of the data gathered to date indicates a higher level of seismisity than was recognized prior to this study. This phenomenon appears to be common to both offshore and onshore areas. Further, consideration of the magnitudes of larger earthquakes indicates that this area is seismically more active than northeast Alaska. Some efforts were directed to investigate icequakes. The results show that fracturing of landfast ice sheets under meteorological instability can be effectively detected by seismic methods. (Sinha-OEIS)
W79-06230

ESTABLISH AND SERVICE A PRODUCT MARINE BASELINE DATA BASE FOR THE ALASKA MEA PROGRAM,
National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data and Information Service.
J. J. Audet.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XIII, Data Management, p 42-63, October 1978. 4 tab, 4 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: Data collections, Data processing, Information exchange, Data storage and retrieval, Alaska, Baseline studies, Water pollution effects, Oil pollution, Resources development, *Outer Continental Shelf, Petroleum development.

Detailed information pertaining to data sets and data reports received and processed by the Data Centers is included in the March 1978 data tracking system and file type summary and other summary tables attached to this report. The majority of data received during the past year were biological data sets. A summary of data sets, data reports and ROSCOPs received during the year is included. (Sinha-OEIS)
W79-06231

A GEOGRAPHIC BASED INFORMATION MANAGEMENT SYSTEM FOR PERMAFROST IN THE BEAUFORT AND CHUKCHI SEAS,
Colorado Univ., Boulder. Institute of Arctic and Alpine Research.
M. Vigdorchik.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XIII, Data Management, p 77-306, October 1978. Chiefly maps. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 3-7-022-35127.

Descriptors: *Permafrost, *Maps, *Basic data collections, Baseline studies, Geography, Environmental effects, Water pollution effects, Resources development, *Outer Continental Shelf, *Information management, Beaufort Sea, Chukchi Sea.

This report includes two independent parts corresponding to the two principal objectives of the work. The first principal objective is to develop a computerized system to aid prediction of the distribution and characteristics of offshore permafrost. Development of this system involves (1) the gathering and study of all the source data about direct and indirect indicators of permafrost in the given area (depth, temperature and salinity of water, topography, bottom deposits, ice conditions, etc.) and (2) the compilation of the derived source ma and, subsequently, construction of candidate ar maps for submarine permafrost in the Beaufort a Chukchi seas. The second objective is to underta a comprehensive review and analysis of past a current Soviet literature on subsea permafrost a related natural processes. The available materi related to problems of submarine permafrost orig and development were given in the Quarterly R ports in 1977; this annual report gives a sho summary of these materials. (Sinha-OEIS)
W79-06232

OCSEAP DATA PROCESSING SERVICES,
Rhode Island Univ., Kingston. Pastore Chemic Lab.
H. Petersen, Jr.
In: Environmental Assessment of the Alaskan Co tinental Shelf. Annual Reports of Principal Invest gators for the Year Ending March 1978, Vol XII Data Management, p 307-335, October 1978. 5 fi NOAA, Outer Continental Shelf Environment Assessment Program, Boulder, Colorado. 03-7-02 35139.

Descriptors: *Data processing, *Quality contro Basic data collections, Baseline studies, Water po lution effects, Alaska, Environmental effects, R sources development, *Outer Continental Shel *Data management, Petroleum development.

Data sets received during the first few months o the year were used to establish the range and typ of validation procedures which were necessary Such procedures were in place by the secon quarter, and have been continually refined base on experience gained from processing additiona data. Improvements were made in the approac and in the types and appearance of the validatio procucts CODEPULL and LOGLIST. A produc developed during the second and third quarte presents a report summarizing the status of eac data set being processed. A copy of this repor FOSREPT, is enclosed and shows the status of al data received during the past year. (Sinha-OEIS
W79-06233

ACUTE TOXICITY OF COPPER TO SOM FISHES IN HIGH ALKALINITY WATER,
Illinois State Water Survey, Urbana.
D. Richey, and D. Roseboom.
Available from the National Technical Informatio Service, Springfield, VA 22161 as PB-294 923 Price codes: A03 in paper copy, A01 in microfiche Circular 131, 1978. 24 p, 6 fig, 5 tab, 43 ref, 2 append.

Descriptors: *Fish toxins, *Toxicity, *Illinois, *Laboratory tests, *Water pollution effects, Copper, Fish, Water pollution, Water quality, Channel catfish, Sunfishes, Data collections, Analytical techniques, Methodology, Bioassay, Alkalinity, Water properties, Mortality.

This study was concerned with documenting the acute toxicity effects that varying concentrations of copper have on certain fishes native to Illinois lakes and streams. The fishes observed were bluegill and channel catfish. Concentrations of copper were quantified in terms of its most toxic fraction to fish, i.e., soluble copper. The bioassays were of 14 days duration, and they were performed with various fish sizes and water temperatures. The results were derived from water high in the salts of calcium and magnesium with correspondingly high alkalinity. Acute toxicity curves were developed for each species permitting assessment for 14-day TL50 (toxicant concentration at which 50% of test specimens survive). The 14-day TL50 at 24C was 2.5 mg/l soluble copper for 0.5 gram bluegill, and 3.7 mg/l soluble copper for 1.5 gram bluegill. In the case of the channel catfish, apparently the more sensitive species to copper, the 14-day TL50 at 22C was 1.2 mg/l soluble copper. For the protection of the fishes investigated and in conjunction with the water pollution regulation of Illinois, the soluble copper levels in Illinois streams having water characteristics similar to those of the dilution water used should not exceed 0.12 mg/l. (Humphreys-ISWS)

W79-06235

ACCLIMATION TO TEMPERATURE AND DEATH AT HIGH CHANGING LETHAL TEMPERATURES IN CYPRINION MACROSTOMUS (HECKEL),
Mosul Univ. (Iraq). Dept. of Biology.
O. A. M. Al-Habbib, and W. M. S. Al-Habbib.
Journal of Thermal Biology, Vol. 4, p 75-77, 1979. 3 fig, 1 tab, 7 ref.

Descriptors: *Environmental effects, *Temperature, Resistance, Fish, Freshwater, Mortality, Lethal temperature, Acclimation.

Results of these laboratory investigations showed that lethal temperature increases with increasing acclimination temperature. LT50 increased from 34.0 to 39.3C, when acclimination temperature increased from 15 to 30C. Survival time at a changing lethal temperature is dependent upon the first lethal temperature to which the fish is exposed as well as the sequence of temperature changes. It is suggested that thermal resistance which occurred in the ascending order of lethal temperatures, may result from additional acclimination attained by the fish while in the resistance zone and that this may be of ecological importance. (Chilton-ORNL)
W79-06266

THE EFFECT OF TEMPERATURE ON THE CONVERSION OF PROINSULIN IN COD, GADUS MORHUA,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biochemistry.
N. Liunardo, and C. L. Hew.
Journal of Thermal Biology, Vol. 4, p 79-83, 1979, 4 fig, 2 tab, 17 ref.

Descriptors: *Environmental effects, *Temperature, Biochemistry, Cod, Enzymes, Hormone activity.

The synthesis of proinsulin and its conversion to insulin were demonstrated at 15C in vitro. At 5C only proinsulin synthesis occurred. The conversion of proinsulin to insulin was found to be temperature-sensitive, reversible, and it was not inhibited by puromycin. It was concluded that the effect of temperature on the conversion of inactive prohormone to biologically active hormone might play an important role in controlling the level of active hormones under various environmental conditions. (Chilton-ORNL)
W79-06298

THE EFFECT OF LIQUID WASTE DISCHARGES FROM STEAM GENERATING FACILITIES,
Battelle Pacific Northwest Lab., Richland, WA.
H. E. McGuire, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-2393, Price codes: A04 in paper copy, A01 in microfiche. Report BNWL-2393, 1977. 45 p, 7 fig, 6 tab, 42 ref, 1 append.

Descriptors: *Electric powerplants, *Water pollution effects, Water quality standards, Waste water, *Model studies, Suspended solids, Chlorine, Hydrogen ion concentration, Nutrients, Heavy metals, Oil, Radioisotopes, Model studies.

The effects of liquid waste discharges from steam electric generating facilities on the environment are summarized. Potential pollutants include chlorine, solids, impaired pH, nutrients, heavy metals (zinc, chrome, phosphorous), oil and grease, heat, and trace radionuclides. Existing water quality indices and development of a new model and scaling functions are discussed. The simple model is a comparative tool intended to be used as an evaluation method on multiple site alternatives. Effluent limitations developed by the Environmental Protection Agency make it almost certain that liquid waste water discharges from new facilities will cause little or no problem to the environment. (Small-FIRL)
W79-06357

ASSESSMENT OF TREATED VS. UNTREATED OIL SPILLS (INTERIM REPORT),
Rhode Island Univ., Kingston. Coll. of Engineering.
M. P. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as HCP/W4047-02, Price codes: A18 in paper copy, A01 in microfiche. Report HCP/W4047-02, 1978. 410 p, 141 fig, 29 tab, 329 ref, append.

Descriptors: *Oil spills, Water pollution effects, Oil pollution, *On-site investigations, *Model studies, *Laboratory tests, *Toxicity, *Entrainment, Feasibility studies, Water pollution control.

A collection of nine papers is presented as part of a feasibility study designed to investigate the nature and extent of problems for assessing the advantages and disadvantages of treated vs. untreated oil spills and meso-scale type experiments and in-situ tests. Topics include: Drop size distributions and mixing energy; An oil spill fates model; Preliminary results of an experiment to measure rain induced oil entrainment; Procedures for qualitative and quantitative treated and untreated spills; Chemical analysis of water samples from meso-scale tanks; Collection and analysis of treated and untreated oil spill vapors; Microbiology: degradation potential; Lethal and sublethal effects of oil and dispersants on young bay scallops Argopecten irradians; A fishery-oil spill interaction model. (Small-FIRL)
W79-06366

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT; VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
For primary bibliographic entry see Field 5A.
W79-06449

PHYSICAL OCEANOGRAPHY,
California State Univ., Fullerton.
N. J. Maloney, and K-M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 1, p 3-1 - 3-65, September 1974. 30 fig, 12 tab, 78 ref.

Descriptors: *Baseline studies, *Waves(Water), *Tides, *Circulation, Resources development, Environmental effects, Water pollution effects, Path of pollutants, Upwelling, *Outer Continental Shelf, Southern California Bight, California Current, Physical oceanography.

Information concerning the oceanic circulation, waves, tides, and physical properties of the water in the Southern California Bight is summarized. Southern California is located on the eastern boundary of the North Pacific Ocean. As a result, the surface water seaward of the offshore islands moves south with the eastern boundary current, the California Current. A southerly current flows north below the California Current, and a southerly surface countercurrent occurs landward of the California Current. Seasonal coastal upwelling, mixed semidiurnal tides, and wave motion cause distinct circulation patterns in the littoral zone. No large tsunamis have been recorded in the Southern California area. This portion of the coast is less susceptible to large tsunamis than other coastal zones because of the wave refraction over the basin and ridge bathymetry of the borderland. The water in the Southern California Bight region of the California offshore is a mixture of relatively low temperature-low salinity water transported south in the California Current with higher temperature-higher salinity water brought north in the California Undercurrent. (See also W79-06449) (Sinha-OEIS)
W79-06452

PHYTOPLANKTON,
California State Polytechnic Univ., Pomona.
For primary bibliographic entry see Field 5B.
W79-06456

ZOOPLANKTON,
California Univ., Irvine.
R. R. Seapy.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 2, p 8-1 - 8-99, September 1974. 3 fig, 16 tab, 54 ref.

Descriptors: *Baseline studies, *Oil pollution, *Water pollution effects, *Zooplankton, Resources development, Environmental effects, Biomass, *Outer Continental Shelf, Southern California Bight.

The species composition and distribution of the zooplankton in waters overlying the borderland are known from a series of studies that span a broad period of time and overlap only occasionally for any given year. Attempts to relate changes in abundance of zooplankton populations to the occurrence of oil spills have been unsuccessful because of the difficulty of relating any changes to oil pollution as the causative factor. The general decline of numbers and biomass was correlated with the general increase in pollution. However, it was not possible to relate these changes to specific pollutants. In addition to the demonstrated toxic effects on zooplankton, indirect effects should also be noted. Beneath a thick oil slick, the penetration of light may be reduced by 90%. Aside from the obvious effects of decreased light intensity on photosynthetic rate by phytoplankton populations, such a decreased light intensity could also disrupt normal patterns of depth distribution for zooplankters, interfere with diel migration patterns, and make visual predators less effective. (See also W79-06449) (Sinha-OEIS)
W79-06457

BENTHIC ALGAE AND GRASSES,
California State Univ., Fullerton.
For primary bibliographic entry see Field 5B.
W79-06458

BENTHIC INVERTEBRATES,
California State Univ., Fullerton.
D. B. Bright.
In: Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 10-1 - 10-291, September 1974. 9 fig, 24 tab, 248 ref.

Descriptors: *Baseline studies, *Benthos, *Invertebrates, *Aquatic communities, Water pollution effects, Resources development, Heavy metals, Chlorinated hydrocarbon pesticides, *Outer Continental Shelf, Southern California Bight, Environmental impact.

The web of organisms found along the Southern California coast is extensive. Numerous benthic invertebrate species show a wide distribution while some are abundant but occur only in selected geographical areas. This report is divided into 3 major sections: major benthic invertebrate communities, environmental impact on benthic invertebrates, and species lists of major groups of benthic invertebrates. The Southern California coastal region contains some of the most rapidly expanding urban complexes in the United States. The waters within a few kilometers of shore are directly influenced by this intense development. If the ocean is to continue to satisfy the often conflicting demands of the human population, both aspects of the environmental quality issue must be considered. The degree to which marine ecosystems can be stretched thus becomes pivotal. Yet, whether it is possible to separate those events which are indigenous to the 'Natural' ecosystem from those due solely to man's influences is problematic. (See also W79-06449) (Sinha-OEIS)
W79-06459

FISHES,
California State Univ., Fullerton.
M. H. Horn.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 11-1 - 11-124, September 1974. 4 fig, 11 tab, 106 ref.

Descriptors: *Fish, *Baseline studies, *Oil pollution, *Environmental effects, Diseases, Heavy metals, Chlorinated hydrocarbon pesticides, Water pollution effects, Resources development, *Outer Continental Shelf, Southern California Bight, Petroleum hydrocarbons, Natural seeps.

The marine environment off southern California with its diverse chemical, physical, and geological characteristics provides a wide variety of habitats for fishes. Although numerous natural oil and gas seeps occur in the region and although oil drilling wastes are among the major wastes dumped in the study area, very little information is available on the effects of these materials on fishes of fisheries in southern California marine waters. In a survey of the effects of the Santa Barbara Channel oil spill, it was reported that fish were still present after the spill and that sampling in the area by the California Department of Fish and Game indicated no adverse effects. An analysis also did not reveal any abnormal conditions of fish and macroplankton populations. The reduction in the fish catch following the spill was said to be due to reduced fishing effort in the oily waters and to harbor closure at Ventura (because of flood damage) and at Santa Barbara (because of the oil spill). More research is needed on the effects of petroleum hydrocarbons on fishes especially in an area such as southern California where the biota is subject to both natural and man-caused contamination. (See also W79-06449) (Sinha-OEIS)
W79-06460

MARINE MAMMALS,
Southern California Ocean Studies Consortium, Long Beach.
M. D. Dailey.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 12-1 - 12-37, September 1974. 8 fig, 2 tab, 48 ref.

Descriptors: *Baseline studies, *Mammals, *Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Cetaceans, Pinnipeds, Carnivores, Southern California Bight, Environmental impact.

The reported marine mammal fauna of Southern California and the Channel Islands consist of cetaceans, pinnipeds and one carnivore. All three of these groups occur or have occurred in the study area, some as residents and others as transient recorded only by incidental sitings. Annotated species lists are presented giving range, study area sitings, population, life history and diseases. (See also W79-06449) (Sinha-OEIS)
W79-06461

MARINE AND SHORE BIRDS,
California State Univ., Long Beach.
K. E. Bender, C. T. Collins, and S. L. Warter.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 13-1 - 13-103, September 1974. 6 tab, 27 fig.

Descriptors: *Baseline studies, *Birds, *Habitats, *Oil spills, Water pollution effects, Environmental effects, Mortality, Resources development, *Outer Continental Shelf, Southern California Bight.

Habitats and the birds which occupy them in the study area of Southern California can be divided into aquatic communities and terrestrial communities. Environmental alterations in either salt or fresh-water habitats usually make considerable, and sometimes major, changes in the other as well. There are several ways in which elements of the bird fauna are highly susceptible to loss or severs (and irreversible) damage through human activity or development. Probably the most readily apparent of these danger points associated with increased human use of the area is the vulnerability of open-water and littoral zone birds to destruction by floating oil. Populations of some of these species have been much reduced in numbers already by various kinds of human interference, and a major oil spill in the area might so deplete the remaining populations that the species would not be able to recover and would be extirpated from the study area. Even in more numerous species where the danger of outright extinction or extirpation is less, the reduction in numbers will affect the population and the interrelated biological community for decades to come. It is essential that great care and attention be given to the prevention of these spills and leaks, rather than to the more dramatic and highly publicized, but largely unsuccessful, after-the-fact rescue and clean-up operations. (See also W79-06449) (Sinha-OEIS)
W79-06462

MARSHES AND BAYS,
California State Univ., Long Beach.
J-S. Ho.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 14-1 - 14-59, September 1974. 8 fig, 9 tab, 126 ref.

Descriptors: *Baseline studies, *Marshes, *Bays, *Ecosystems, *Biota, Crustaceans, Monitoring, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Southern California Bight, Polychaeta, Environmental impact.

There are nineteen major coastal embayments in Southern California. Only three of them have remained relatively unaltered, i.e., Anaheim Bay, Upper Newport Bay, and Tijuana Estuary. Since very little biological survey of the marshes and bays was done in the past, a checklisted information of the flora and fauna of the area cannot be prepared. The biota of Anaheim Bay are comparatively better known and probably represent a possible flora and fauna of the Southern California coastal embayments before alteration. Several species of fish utilize the bay for spawning and nursery grounds and a great many species of birds use it as nesting, feeding, and shelter area. Polychaeta is the single most studied group of organisms, for certain species of them can be used as indicators of the bottom condition for monitoring pollution. A new form of extremely rare Crustacea was recovered from Anaheim Bay. It belongs to Cephalocarida, which is the most primitive living Crustacea of the world. The existing condition of biological knowledge underscores the difficulty in understanding the ecosystem of the coastal embayments and their relationship with the total coastal ecology, since a biological inventory is lacking and only a few species are known to a level of quantitative characterization, e.g., biomass, density per unit area, environmental cost. (See also W79-06449) (Sinha-OEIS)
W79-06463

RECOMMENDATIONS FOR BASELINE RESEARCH IN CENTRAL AND NORTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings of Conference/Workshop held in San Francisco, California, on October 22-24, 1976, Sponsored by the Bureau of Land Management, Niesen, T.M. (Ed.). San Francisco State University, San Francisco, CA School of Science. January 1977, 285 p, 4 append.

Descriptors: *Baseline studies, *Continental Shelf, *Resources development, Monitoring, Fisheries, Wildlife, Water pollution effects, Water pollution sources, *Outer Continental Shelf, Northern California, Central California.

During three days of meetings at the conference on baseline research in northern and central California relative to offshore resource development, the participants in the conference developed a number of recommendations for baseline research in this geographical area. The first section of this initial report represents an attempt to coordinate the recommendations, and to group them into four categories: general recommendations which speak to the overall framework in which the research is to be carried out, recommendations for baseline studies, recommendations for monitoring studies, and recommendations for special projects. The second section of the report attempts to establish an operational framework within the work which is de signed to optimize the utilization of resources an to encourage an interdisciplinary understanding o the north and central California continental shel region. (See W79-06465 thru W79-06467) (Sinha OEIS)
W79-06464

SEA-FLOOR INSTABILITY OF CONTINEN TAL SHELF OFFSHORE CENTRAL ANI NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
For primary bibliographic entry see Field 2J.
W79-06465

OCEANIC AND ATMOSPHERIC VELOCITY FIELDS AND WATER CHEMISTRY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2K.
W79-06466

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
J. L. Baxter.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resources Development', Proceedings of Conference/Workshop, held in San Francisco, CA, October 22-24, 1976, p 129-135, January 1977.

Descriptors: *Resources, Development, *Data collections, Baseline studies, Fisheries, Wildlife, Birds, Mammals, Water pollution effects, Oil pollution, Drilling, *Outer Continental Shelf, Petroleum development, Northern California, Central California.

The potential impacts of offshore oil and resource development on fisheries are of two principal types. One is the actual effects of petroleum products upon any or all developmental stages of the organisms themselves resulting from a spill or other accident. The other is the 'preemption' of fishing grounds by drilling operations, various underwater structures such as pipelines, wellheads, etc., and other activities related to activities in the offshore area. Marine birds are particularly sensitive to man's exploitation of resources in the marine environment. Some sea birds are more vulnerable to oil at sea than almost any other organism. There is not a great deal of information particularly of a systematic and continuing type on the distribution and abundance of marine birds. Studies of the effects of oil pollution on marine mammals are not extensive and no accurate prediction on its impact can be made at this time. Some studies have indicated that surface exposure to oil has relatively little effect on non fur-bearers, such as stellar and California sea lions, elephant seals, and harbor seals. The sea otter is one of the most susceptible to oil spills and most studied. It is quite obvious that although many of the data systems are in excellent shape, there is a great deal of information needed if we are to design programs which will provide the data necessary to evaluate offshore resource development. (See also W79-06464) (Sinha-OEIS)
W79-06467

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings, Conference/Workshop, December 15-17, 1976, Portland, Oregon. Research Triangle Institute, Research Triangle Park, NC, February 1977. Massoglia, M.F. (Comp.). 313 p, 4 append. AA550-CT6-54.

Descriptors: *Baseline studies, *Washington, *Oregon, *Resources development, *Planning, *Management, Exploration, Drilling, Hazards, Water pollution sources, Water pollution effects, Fisheries, Birds, Biota, *Outer Continental Shelf, Petroleum development.

The conference/workshop was cosponsored by the Bureau of Land Management and conducted and cosponsored by the Research Triangle Institute. The objectives were: to summarize available information needed to understand the environmental processes of the Continental Shelf off Washington and Oregon; to provide any predictions presently possible of the effects of OCS oil and gas development on the environment of the Washington and Oregon OCS area; to identify subject areas in which additional information is required for reasonable prediction and understanding of the environmental effects of oil and gas development in this area; and to formulate recommendations for a studies program that will help determine the environmental impacts of drilling in the Washington and Oregon OCS area. The recommendations of the various workshops are summarized and structured into priority groupings. Study recommendations to develop environmental data required for decisionmaking during leasing activities are considered to be of the highest priority and are placed in Group I. Studies designed to develop data required for the exploratory-drilling and production-drilling phases are placed in Group II, and other construction activities and production operations are in Group III. Studies associated with abnormal conditions could fall into any of the three groups, depending on what phase of operation is concerned. (Sinha-OEIS)
W79-06468

RECOMMENDATION FOR BASELINE RESEARCH IN SOUTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings of Conference/Workshop held in Long Beach, California, on December 5-7, 1974, Sponsored by the U.S. Bureau of Land Management. February 1975. Lavenberg, R.J. and Earle, S.A. (Eds.). Southern California Academy of Sciences, Los Angeles. 266 p, 8 append.

Descriptors: *California, *Resources development, *Baseline studies, *Planning, *Continental Shelf, Environmental effects, Water resources, Water pollution effects, Aquatic biology, Oil pollution, Leases, *Outer Continental Shelf, *Southern California, Petroleum development, Environmental impact.

The conference and workshops were organized in such a manner that the proceedings resulting from them would summarize the environmental knowledge about the southern California Outer Continental Shelf and coastal areas. Specifically, the objectives for these meetings were: (1) to expose as much information as possible about each geographic area and discipline; (2) to provide a summary of available related information and understanding for a portion of the Continental Shelf as designated by the Bureau of Land Management in the southern California area; (3) to identify the areas of knowledge in which additional information is essential for reasonable prediction and understanding of the environmental effects of drilling in this area; (4) to formulate recommendations for baseline and monitoring programs adequate for determination of the environmental effects and impact of oil and gas development on the Outer Continental Shelf in this area; and (5) to provide wide public participation and exposure. (Sinha-OEIS)
W79-06469

U.S. GEOLOGICAL SURVEY OFFSHORE PROGRAM OF RESOURCE AND GEO-ENVIRONMENTAL STUDIES AND TOPICAL INVESTIGATIONS, PACIFIC - ARCTIC REGION,
Geological Survey, Menlo Park, CA.
D. W. Scholl.
Open-File Report No 78-422, 1978. 113 p, 22 fig, 2 tab, 4 append.

Descriptors: *Pacific Ocean, *Arctic Ocean, *Bibliographies, *Resources development, Geology, Oil, Gases, Environment, *Outer Continental Shelf, Petroleum development, Geo-environmental studies.

The Geological Survey's marine geology investigations in the Pacific-Arctic area are presented in this report in the context of the underlying socio-economic problem of expanding the domestic production of oil and gas and other mineral and hard- and soft-rock resources while maintaining acceptable standards in the marine environment. The primary mission of the Survey's Pacific-Arctic Branch of Marine Geology is to provide scientifically interpreted information about the (1) resource potential, (2) geo-environmental setting, and (3) overall geologic characteristics of the continental margins (that is, the continental shelf, slope and rise) and adjacent deeper water and shallower coastal areas off California, Oregon, Washington, Alaska and Hawaii and also, where it is of interest to the U.S. Government, more remote deep-sea areas of the Pacific-Arctic realm. (Sinha-OEIS)
W79-06470

SURFACE CURRENTS IN THE NEW YORK BIGHT AS RELATED TO A SIMPLE OIL TRAJECTORY MODEL,
National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data and Information Service.
J. M. Bishop.
In: Preprint Volume: Conference on Coastal Meteorology, held Virginia Beach, VA on September 2123-1976. p 98-101, 1976. 4 fig, 8 ref. American Meteorological Society, Boston, Mass.

Descriptors: *New York, *Oil spills, *Models, *Water pollution effects, *Path of pollutants, Environmental effects, Baseline studies, *Outer Continental Shelf, *New York Bight, *Oil trajectory, Surface currents, Petroleum development.

A hypothetical path of oil movement is generated by computing trajectories from each third hourly wind observation. The results of two simulated spills are presented as probability diagrams. About 1000 simulated spills were used for each spill site. These diagrams indicate the percentage of time that a 10 mile x 10 mile offshore area and 10-mile coastal segments would be impacted by the calculated oil trajectories on an annual basis. Oil movements from both spill sites exhibit a strong offshore tendency. This might be explained in terms of the seasonal march of the annual wind and density field in the New York Bight. In the summer, winds are weak and combine with a strong southwesterly baroclinic flow to produce generally longshore oil movement. During the winter a strong eastward mean wind and a relatively weak baroclinic flow give a strong offshore tendency for oil movement. Thus, the annual pattern of oil movement exhibits a marked offshore and longshore (southerly) character. (Sinha-OEIS)
W79-06471

ATLANTIC OFFSHORE PROGRAM. A PRELIMINARY PLAN TO OBTAIN VITAL INFORMATION FOR THE NATION TO PROTECT AND USE ITS OFFSHORE RESOURCES,
Draft Report, prepared at the Atlantic Offshore Program Planning Workshop held at Newark, Delaware on September 19-21, 1977. Also as Delaware University Sea Grant Report No. DEL-SG-19-77m 1977. 464 p.

Descriptors: *Resources development, *Oceanography, *Baseline studies, *Conferences, *Engineering, Sediment transport, Dredging, Ocean waves, Soils, Pipelines, Management, Geology, Biology, Environmental effects, *Outer Continental Shelf, U.S. East Coast, Coastal processes, Geotechnical properties, Dredged material.

This workshop was a sequel to the May problem identification workshop and was held at the University of Delaware on September 18-21, 1977 and hosted by the 15 east coast Sea Grant institutions. The objective of this second workshop was the development of a preliminary plan for a comprehensive, economical, practical and sound oceanographic/oceanographic engineering program to solve, or shed useful light, on the priority problems identified in the users workshop of May 19-21, 1977. Task Groups reported on the following problems: dredged material disposal and sediment transport processes; assimilative capacity of the Atlantic offshore area; wave data acquisition and use; management of living resources; modeling physical processes; Atlantic offshore area and resources management; soil strength and stability; interaction of structures, equipment and marine environment. Specialty Teams prepared program plans for certain activities to strengthen and broaden the program. These activities are: physical oceanography; biological oceanography, chemical oceanography, geology and geophysical oceanography, instrumentation, communications, public interest and state participation, and management. (Sinha-OEIS)
W79-06472

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-06473

ANALYSIS OF BRINE DISPOSAL IN THE GULF OF MEXICO. BIOASSAY RESULTS.
National Oceanic and Atmospheric Administration, Washington, DC. Center for Experiment Design and Data Analysis.
Report to the Department of Energy Strategic Petroleum Reserve Program, Salt Dome Storage, March 1978. 118 p, 34 ref, 5 append.

Descriptors: *Gulf of Mexico, *Brine disposal, *Bioassay, *Baseline studies, *Salinity, Water pollution effects, Plankton, Benthos, Resources development, *Outer Continental Shelf, Petroleum development, Biological tolerance, Salinity tolerance, Environmental effects.

As crude oil is pumped into an existing cavern for storage, saturated brine is displaced and brought to the surface for disposal. Disposal of this brine into the Gulf of Mexico is one alternative and the Department of Energy has requested that NOAA assess the environmental consequences of such an operation. The offshore brine discharge is believed to primarily affect planktonic larvae and benthic species. The hypersaline tolerances of benthic and nektonic species expected to be present in the proposed disposal area, which may include penaeid shrimp, as well as important nektonic species, such as croaker, redfish, spot, black drum, sheepshead, and seatrout. There are no well-defined limits of biological tolerance to hypersaline conditions, and each species has a range of optimum salinity for growth and reproduction. Rate, duration, and magnitude of salinity changes are therefore important to assess the potential biological impact. Laboratory studies of salinity sensitivity of various organisms were conducted by NOAA contractors. The final reports on these studies are reproduced as appendices to this report. (Sinha-OEIS)
W79-06474

EFFECTS OF OCEAN DUMPING ACTIVITY MID-ATLANTIC BIGHT - 1976 INTERIM REPORT,
Environmental Protection Agency . Annapolis, MD.
D. W. Lear, M. L. O'Malley, and S. K. Smith.
Report No. EPA 903/9-77-029, July 1977. 184 p, 93 fig, 34 tab, 19 ref.

Descriptors: *Waste disposal, *Sewage sludge, *Water pollution effects, *Monitoring, Metals, Polychlorinated biphenyls, Mortality, Clams, Benthos, Mollusks, Sediments, Resources development, *Outer Continental Shelf, *Mid-Atlantic Bight, *Ocean dumping, Arctica islandica.

Significantly high concentrations of metals known to be present in City of Philadelphia sewage sludge can be found on occasion at points in the sediments in and near the sludge release site. Several bands with consistently high concentrations of metals, in association with high organic carbon, have been partially identified and have persisted for at least

fourteen months in and adjacent to the southern part of the sludge release site. Polychlorinated biphenyls (PCB's) were widely distributed in concentrations that may be inimical to marine organisms. The time distribution indicated cyclical inputs, possibly from the coastal zone. Localized areas of high impact, associated with other parameters from sewage sludge, have been identified. Mortalities of the mahogany clam, Arctica islandica, were indicated at loci in and near the ocean dumping activity. Detailed bathymetry of the persistently impacted area south of the sludge release site indicates gentle geomorphic features may affect the aggregation of dumped materials. Statistically significant changes of the benthic infaunal communities are occurring in the impacted area south of the sewage sludge release site. A preliminary indication of diseased macrofauna associated with the impacted area was found in February 1977. Molluscan shellfish in the vicinity of the sewage sludge site appear to harbor bacteria of sanitary significance. (Sinha-OEIS)
W79-06475

POLLUTING INCIDENTS IN AND AROUND U.S. WATERS, CALENDAR YEAR 1977.
Coast Guard, Washington, DC.
Commandant Instruction No. M16450.2 (old CG-487), July 1978. 33 p.

Descriptors: *United States, *Water pollution, *Data collections, *Oil spills, Water pollution sources, Baseline studies, Resources development, *Outer Continental Shelf, Petroleum development, Oil transport.

The Federal Water Pollution Control Act requires that any discharge of oil or hazardous substance in harmful quantities, be reported to the 'appropriate agency of the United States Government'. The Coast Guard has been designated as that agency by Executive Order 11735. The Pollution Incident Reporting System (PIRS) serves two purposes: first, it functions as a management information system for the Marine Environmental Protection Program; and second, it provides a means to respond to frequent inquiries from Congress, the press, special interest groups and the public concerning marine pollution and Coast Guard activities to protect the environment. Presently, the system contains data which describes the nature of the discharge, the response (cleanup) to the discharge and penalty actions. (Sinha-OEIS)
W79-06476

SUMMARIZATION AND INTERPRETATION OF HISTORICAL PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION FOR THE MID-ATLANTIC REGION,
National Oceanic and Atmospheric Administration, Washington, DC. Center for Experiment Design and Data Analysis.
R. G. Williams, and F. A. Godshall.
Final Report to the U.S. Bureau of Land Management, October 1977. 305 p. AA550-1A6-12.

Descriptors: *Oceanography, *Meteorology, *Path of pollutants, *Baseline studies, Water pollution, Oil spills, Environmental effects, Data, *Outer Continental Shelf, Mid-Atlantic region.

The results of an environmental study of the Mid-Atlantic region of the Outer Continental Shelf is presented. The area defined for this study is the area extending northward from 38 degrees N to 41 degrees N latitude between the coast and the 2,000 m isobath. The surface wind field, which plays an important role in determining the movement of spilled oil and other pollutants, is dealt with in detail. A major part of the report is devoted to the physical characteristics of the water masses in the Mid-Atlantic region, whose structure and variability are particularly relevant to the dispersion and advection of pollutants. Since diffusion, mixing, and advection are seldom measured directly, the potential for these processes must be inferred from analysis of such variables as water temperature, salinity, and density. In addition to an analysis of the surface and subsurface water temperature and salinity, data on dissolved oxygen and nutrient concentrations are presented, since these data are important for an evaluation of potential degradation rates of ocean pollutants. Circulation features analyzed include the mean surface current field and its variability, which act directly to advect and disperse pollutants; subsurface currents and their tidal constituents; and subtidal flows which produce large water mass characteristics. Some inferences concerning vertical mixing are drawn. Ocean waves are discussed which includes estimates of return periods of extreme wave heights in the region. Finally, the data used are evaluated in terms of reliability and deficiencies and recommendations are made for the design of future field programs to fill existing gaps in the data needed for an adequate environmental assessment. (Sinha-OEIS)
W79-06477

BEHAVIORAL THERMOREGULATION AND DIEL ACTIVITY IN WHITE SUCKER (CATOSTOMUS COMMERSONI),
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol. 59A, p 261-262, 1978. 10 ref.

Descriptors: *Environmental effects, *Temperature, *Fish behavior, Laboratory tests, Suckers, *Thermoregulation, Preferred temperature.

White suckers were tested in an electronic thermoregulatory shuttle box, which permits a fish to control water temperatures by its movements between chambers monitored by photocells, to determine temperature preference. The range of preferred temperatures was the same during both day and night (22.8 to 26.1C) but the mode changed by 1C from 24C at night to 25C during the day. 89% of all activity occurred during the dark period. (Chilton-ORNL)
W79-06478

METABOLIC RATE, TEMPERATURE ACCLIMATION AND RESISTANCE TO HIGH TEMPERATURE OF SOFT-SHELL CLAMS, MYA ARENARIA, AS AFFECTED BY SHORE LEVEL,
Maine Univ. at Orono. Dept. of Zoology.
G. Anderson.
Comparative Biochemistry and Physiology, Vol 61A, p 433-438, 1978. 4 fig, 2 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Respiration, Clams, Intertidal areas, Resistance, Temperature acclimation.

Clams were collected from four levels (subtidal, low intertidal, mid intertidal and high intertidal) of a rocky beach. Oxygen consumption rates were measured at varying temperatures. It was found that, for intermediate size clams, metabolic rates were highest at the high intertidal level and lowest at the low intertidal level with subtidal and mid intertidal clams having intermediate rates. Clams from low intertidal levels showed near-complete metabolic compensation to temperature change. Clams from mid and high intertidal levels showed partial compensation. Clams from the subtidal level showed supraoptimal compensation. Warm acclimated clams from the subtidal level were found to be metabolically independent at temperatures ranging from 10 to 25C. Clams from subtidal and high intertidal levels were more resistant to high temperature (25C) than those from low and mid intertidal levels. (Chilton-ORNL)
W79-06479

BEHAVIORAL THERMOREGULATION IN THE ROCK BASS, AMBLOPLITES RUPESTRIS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol 60A, No 4, p 263-264, 1978. 1 fig, 11 ref.

Descriptors: *Environmental effects, *Temperature, *Fish behavior, Bass, Photoperiodism, Thermoregulation, Preferred temperature.

Adult rock bass were tested in an electronic thermoregulatory shuttlebox, which permits a fish to control water temperatures by its movements between chambers monitored by photocells, to determine the occurrence of preferred temperature or locomoter activity. The fish attained final thermal preferendum at 30C within 24 hours and showed no difference in preferred temperature or in locomotor activity between day and night. (Chilton-ORNL)
W79-06480

ONTOGENETIC CHANGE IN PREFERRED TEMPERATURE AND DIEL ACTIVITY OF THE YELLOW BULLHEAD, ICTALURUS NATALIS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol 59A, p 409-411, 1978. 1 tab, 25 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Fish behavior, Biorhythms, Photoperiodism, Preferred temperature.

Adult and juvenile yellow bullheads were tested in an electronic shuttle box which permits a fish to control water temperatures by its movements between chambers monitored by photocells. The 24-hr mean preferred temperature of juveniles was 28.8C and of adults was 27.6C. Relatively little difference was seen in preferred temperatures among dusk, night and day periods. Juveniles were most active (40% of total 24 hr activity) during dusk period and adults were most active (63%) at night. In both cases, the respective 24-hr mean temperatures were equal to the mean preferred temperature during the period of greatest activity but there was no consistent relationship between highest and lowest preferred temperatures and the activity cycle. (Chilton-ORNL)
W79-06481

THE FINAL THERMAL PREFERENDUM OF FISHES: SHUTTLING BEHAVIOR AND ACCLIMATION OVERSHOOT,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds.
Hydrobiologia, Vol 57, No 2, p 123-124, 1978. 14 ref.

Descriptors: *Environmental effects, *Thermal pollution, Fish, Temperature, Fish behavior, Temperature preferendum.

Because fish tend to shuttle back and forth within a range of temperatures above and below the preferendum and because they acclimate more rapidly to increasing than to decreasing temperatures, it is suggested that they become acclimated nearer to the maximum than to the mean of a cycled thermal regime. Thus, thermoregulating fish can become acclimated to a temperature exceeding the final preferendum, even when given a free choice. These considerations imply that the ultimate temperature to which fish will gravitate in a gradient may not equal the crossover point at which preference and acclimation are equal. It is suggested that in future work it may be necessary to differentiate between crossover point and ultimate preferenda where these can be shown to differ significantly. (Chilton-ORNL)
W79-06482

GROWTH AND ADAPTATION TO SEA WATER IN UNDERYEARLING SOCKEYE (ONCORHYNCHUS NERKA) AND COHO (O. KISUTCH) SALMON SUBJECTED TO REGIMES OF CONSTANT OR CHANGING TEMPERATURE AND DAY LENGTH,
Fisheries and Marine Service, Nanaimo (British Columbia).
W. C. Clarke, J. E. Shelbourn, and J. R. Brett.

Canadian Journal of Zoology, Vol 56, No 11, p 2413-2421, 1978. 8 fig, 2 tab, 33 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Growth rates, Salmonids, Sockeye salmon, Smolt, Photoperiodism, Animal physiology, Underyearlings, Coho salmon.

Regimes of constant as well as changing temperature and day length were found to influence growth and osmoregulatory performance of sockeye and coho salmon. Changing temperatures did not influence the final length or weight achieved by the fish in comparison with a constant temperature of the same mean but the growth patterns were different. Temperature controlled the rate of response to photoperiod and thus changes in growth rate due to photoperiod treatments were evident at higher temperatures before they were at lower temperatures. It was concluded that artificial photoperiod treatments are not required to produce underyearling sockeye smolts in the spring, provided that water temperatures are adequate for growth to 75 mm. Coho smoltify at a larger size than sockeye and would need higher temperatures to produce underyearling smolts in the spring. (Chilton-ORNL)
W79-06483

THE IMPORTANCE OF HABITAT TEMPERATURES FOR GROWTH IN THE TROPICAL CICHLID TILAPIA RENDALLI BOULENGER,
Rhodesia Univ., Salisbury. Hydrobiology Research Unit.
M. S. Caulton.
Journal of Fish Biology, Vol 13, No 1, p 99-112, July 1978. 4 fig, 6 tab, 32 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Growth rates, Biorhythms, Fish behavior, Diel migration, Diurnal distribution, Tilapia rendalli.

Growth of Tilapia rendalli was investigated using a bioenergetic model to measure the effects of temperature on laboratory satiation, gross assimilation efficiency, calorigenic cost of food processing, ammonia excretion and energy budget. It was found that growth of the fish was enhanced by daily movement into areas of warm (as high as 34C) water during the day and return to cooler water (18C) at night. Optimal temperatures were predicted to be 18 and 30C. (Chilton-ORNL)
W79-06484

GROWTH, FOOD CONVERSION AND SURVIVAL OF O-GROUP ENGLISH SOLE (PAROPHRYS VETULUS GIRARD) AT FIVE TEMPERATURES AND FIVE RATIONS,
Oregon State Univ., Newport. Marine Service Center.
S. F. Williams, and R. S. Caldwell.
Aquaculture, Vol 15, No 2, p 129-139, October 1978. 6 fig, 1 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, *Food abundance, Growth rates, Fish, Mortality, Juveniles, English sole, Parophrys vetulus.

Young sole used in these investigations were fed a diet of Oregon Moist Pellets and were exposed to constant temperature-ration combinations between 9.5 and 21C and 0 and 16% rations for 12 weeks. Growth rate of the sole juveniles fed restricted rations was generally inversely related to temperature. Food conversion efficiency was highest (10.5% dry weight basis) at 8% ration and at 9.5C. Survival was low in all groups but highest at lower temperatures and higher rations. Several disease organisms caused or were associated with mortalities.
W79-06485

GROWTH AND SPAWNING IN THE PECTINID CHLAMYS OPERCULARIS IN RELATION TO TEMPERATURE AND PHYTOPLANKTON CONCENTRATION,
Portsmouth Polytechnic (England).
M. J. Broom, and J. Mason.
Marine Biology, Vol 47, No 3, p 277-285, 1978. 6 fig, 4 tab, 17 ref.

Descriptors: *Environmental effects, *Temperature, Food abunance, Mollusks, Growth rates, Spawning.

Growth rates and spawning conditions of queen scallops were monitored over a period of 18 months. Temperature and phytoplankton standing crop were also monitored. Shell growth was observed by the formation of lamellae and was found to occur most regularly under conditions of moderately high temperature and good food availability. Rapid growth in the spring resulted in the formation of a distinct ring. Development of the gonads and subsequent spawning did not appear to influence linear growth or lamella formation significantly. (Chilton-ORNL)
W79-06486

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
G. S. Canterford, A. S. Buchanan, and S. C. Ducker.
Australian Journal of Marine and Freshwater Research, Vol 29, No 5, p 613-622, October 1978. 6 fig, 3 tab, 31 ref.

Descriptors: *Environmental effects, *Water pollution, Heavy metals, Absorption, Algae, Diatoms, Zinc, Lead, Copper, Cadmium, Biological concentration factor.

Accumulation of copper, zinc, cadmium, and lead by Ditylum brightwellii is reported. In the case of copper, no definite correlation was found between the amount of metal taken up by the diatoms and the metal concentration to which it was exposed. The amount of metals taken up generally increased with increasing concentration of the other metals studied. Metal uptake by the diatom was in the order of Zn > Pb > Cu > Cd. (Chilton-ORNL)
W79-06487

THE SURVIVAL OF EMBRYOS OF THE ANNUAL FISH NOTHOBRANCHIUS GUENTHERI EXPOSED TO TEMPERATURE EXTREMES AND THE SUBSEQUENT EFFECTS ON EMBRYONIC DIAPAUSE,
Orentreich Foundation for the Advancement of Science, Inc., New York.
J. R. Matias, and J. Markofsky.
Journal of Experimental Zoology, Vol 204, No 2, p 219-228, May 1978. 4 fig, 3 tab, 34 ref.

Descriptors: *Environmental effects, *Temperature, Growth stages, Fish, Embryonic growth stage, Diapause, Mortality, Nothobranchius guentheri.

Embryos of Nothobranchius guentheri were exposed to temperatures of -8.0, +3.4, 9.0, 32.7, 2nd 40.0C to determine thermal tolerance and responsiveness of embryos at diapause and at stages exclusive of diapause. Fully developed embryos and those at early stages of development were the most sensitive to temperature extremes. Specific early stages were not distinguished. Short exposure of Diapause I embryos to -8 and 3.4C eliminated Diapause II, while short exposure to 40C enhanced its duration. It was concluded that temperature is an important factor in influencing onset and duration of the diapauses. (Chilton-ORNL)
W79-06488

UPPER LETHAL WATER TEMPERATURE LEVELS FOR ENGLISH SOLE (PAROPHRYS VETULUS) AND ROCK SOLE (LEPIDOPSETTA BILINEATA) SUBJECTED TO GRADUAL THERMAL INCREASES,
National Marine Fisheries Service, Seattle, WA.
W. E. Ames, J. R. Hughes, and G. F. Slusser.
Northwest Science, Vol 52, No 3, p 285-291, 1978. 3 fig, 3 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal stress, Thermal pollution, Temperature, Fish, Mortality, Seasonal, English sole, Rock sole.

Thermal tolerance studies are reported on 483 English sole and 260 rock sole. Test procedure was to gradually raise the temperature from ambient during the first hour, hold a test temperature (18, 21, 24, or 27C) for the next 4 hours, and gradually reduce temperature to ambient level during the 6th hour. Fish were observed during a 7 day period following tests. LL50 was found to be 26.1C for English sole and 24.9C for rock sole in the 27C test. LL50 was not reached at the other test temperatures. Death caused by thermal stress for both species was highest at each extreme of the respective size ranges. Total mortalities were 20% for English sole and 35% for rock sole. Mortality rates for both species appeared to be somewhat independent of seasonal water temperature fluctuations. (Chilton-ORNL)
W79-06489

DIEL PATTERNS OF PREFERRED TEMPERATURE AND LOCOMOTOR ACTIVITY IN THE GOLDFISH CRASSIUS AURATUS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, M. E. Casterlin, J. K. Matthey, S. T. Millington, and A. C. Ostrowski.
Comparative Biochemistry and Physiology, Vol 59A, p 225-227, 1978. 2 fig, 28 ref.

Descriptors: *Environmental effects, *Temperature, Fish behavior, Biorhythms, Preferred temperature.

Goldfish were tested in an electronic thermoregulatory shuttle box which permits a fish to control water temperatures by its movements between chambers monitored by photocells. Data showed a circadian rhythm with a unimodal peak (29.7C) of preferred temperature occurring during the 4 hrs preceding onset of the light period. Mean preferred temperature was 27.7C. Locomotor activity showed a bimodal pattern, with peaks occurring at the beginning and end of the dark period. There was no significant correlation (r=0.05) between temperature and activity. It was concluded that the most significant finding of the study was that the peak of the preferred temperature cycle of goldfish occurs during the same time period in which goldfish respond most favorably in body weight gain and in gonosomatic index to increased temperature. (Chilton-ORNL)
W79-06490

THE EFFECT OF THE RATE OF CHANGE OF TEMPERATURE ON THE RESISTANCE OF ASELLUS AQUATICUS (L.) TO HIGH LETHAL TEMPERATURES,
Trinity Coll., Dublin (Ireland). Dept. of Zoology.
T. M. Salih, and J. N. R. Grainger.
Journal of Thermal Biology, Vol 3, No 3, p 121-123, July 1978. 5 fig, 6 ref.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Temperature, Rates, Aquatic life, Adaptation, Acclimation, Temperature acclimation, Poikilotherms.

In this study on the effect of temperature rate change on survival at high temperatures it was found that the heat resistance of adult Asellus aquaticus increased with increasing acclimation temperature. Animals which had been acclimated to 20C and then heated to 35C at a rate of 1C/4 min were found to be less resistant at 35C than those placed directly at 35C. Similarly acclimated animals which were slowly heated to 30C and then suddenly placed at 35C exhibited increased heat acclimation in the more resistant individuals. It was concluded that when 20C acclimated Asellus are subjected to rising temperature, further acclimation takes place up to about 30C and this is most marked in the more resistant individuals. Above 30C the animals are adversely affected and this becomes progressively more intense as the temperature rises to 35C. (Chilton-ORNL)
W79-06491

EFFECT OF TEMPERATURE AND SALINITY ON HEAT TOLERANCE OF EMERITA HOLTHUISI,

Institute of Science, Bombay (India). Dept. of Zoology.
K. M. Kulkarni.

Geobios, Vol 5, No 3, p 97-100, 1978. 1 tab, 10 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Resistance, Salinity, Intertidal areas, Aquatic animals, Invertebrates, Crabs, Sand crabs.

Sand crabs were tested in four combinations of temperature and salinity (20 or 30C and 20% or 32% salinity). It was found that acclimation to high temperature generally increased resistance to lethal temperature and that low salinity generally decreased resistance. The most favorable combination for resistance to high temperature was acclimation to high temperature and high salinity. (Chilton-ORNL)
W79-06492

IMPLICATION OF GEOGRAPHIC LOCATION ON TEMPERATURE PREFERENCE OF WHITE PERCH, MORONE AMERICANA,

Maryland Univ., Frostburg. Center for Environmental and Estuarine Studies.
L. W. Hall, Jr., C. H. Hocutt, and J. R. Stauffer, Jr.

Journal of the Fisheries Research Board of Canada, Vol 35, No 11, p 1464-1468, 1978. 2 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Perches, White perch, Location, Seasonal, Geographical regions, North Carolina, New Jersey, Maryland, Temperature preference.

Fish used in this study were collected from Albemarle Sound, N.C.; Wicomico River, MD; and Mullica River, N.J. Collection temperatures were 25C for each population. Fish were acclimated to 6, 12, 18, 24, 30, and 33C. Final temperature preference (calculated from linear regression) were 32.4C for North Carolina populations; 28.9C for Maryland populations; and 29.6C for New Jersey populations. Calculated final temperature preference (using the quadratic equation) for N.C., Md., and N.J. populations were 31.6, 29.3, and 29.2C, respectively. Final temperature preference from visual estimation were 32.5C for N.C. populations, 30.6C for Md. populations, and 28.6C for N.J. populations. It was concluded that geographical variations in temperature responses of white perch are a result of environmental differences found in each ecosystem. Yearly water temperature extremes of the three locations showed great variation. Nonthermal seasonal influences associated with each location could represent another possible means for influencing temperature preference. (Chilton-ORNL)
W79-06493

EFFECTS OF TEMPERATURE AND SALINITY ON THE METABOLISM AND BYSSAL FORMATION OF BRACHIDONTES VARIABILIS KRAUSS (BIVALVIA),

Hebrew Univ., Jerusalem (Israel). Dept. of Zoology.
S. Stern, and Y. Achituv.

Comparative Biochemistry and Physiology, Vol 59A, No 1, p 101-105, 1978. 6 fig, 3 tab, 25 ref.

Descriptors: *Environmental effects, *Temperature, *Salinity, Thermal stress, Adaptation, Metabolism, Intertidal areas, Mollusks.

Animals were acclimated to 21C and 42% salinity and then exposed to varying experimental regimes of temperature and salinity. It was found that an increase in temperature (from 27 to 33C) resulted in a net decrease in oxygen uptake. An increase in salinity (from 47 to 58%) resulted in a decrease in oxygen uptake. Combined increase in temperature and salinity resulted in initial fluctuations in oxygen uptake with a return to pretest rates. Nitrogen excretion increased in most of the experiments. At most of the temperature-salinity combinations, byssal activity recovered partially as compared to the acclimation conditions where byssal formation was 100%. At 33C, the first incidence of mortality was recorded 13 days after the start of the experiment. At 27C, the first mortality was found on the 26th day and 50% of animals were dead by the 96th day. It was concluded that the metabolic adaptation of this species is responsible for its ability to cross the Suez Canal and enter the Mediterranean. (Chilton-ORNL)
W79-06494

EFFECT OF TEMPERATURE, PH, ANTIBIOTICS, FORMALIN AND MALACHITE GREEN ON THE GROWTH AND SURVIVAL OF SAPROLEGNIA AND ACHLYA PARASITIC ON FISH,

Fisheries Research Inst., Szarvas (Hungary).
J. Olah, and J. Farkas.

Aquaculture, Vol 13, No 3, p 273-288, March 1978. 4 fig, 7 tab, 19 ref.

Descriptors: *Environmental effects, *Temperature, Hydrogen ion concentration, Parasites, Fish, Growth rates, Fungi, Fungicides, Fish parasites.

Twenty four strains of Saprolgenia and Achlya were isolated and tested for growth at different temperature and pH levels. Sensitivity and survival were determined for antibiotics and 40 combinations of formalin, malachite green and formalin-malachite green mixture. It was found that at low temperatures Saprolegnia strains grew faster than Achlya strains and that they germinate and begin growth in the spring at temperatures as low as 5C. Saprolegnia strains grew at a wider range of pH than Achlya strains. Nalidixic acid was the only antibiotic tested which exhibited an inhibiting effect on growth. Mixtures of malachite green and formalin were found to be the best fungicides. (Chilton-ORNL)
W79-06495

SYNERGISTIC EFFECTS OF TEMPERATURE, SALINITY AND LIGHT ON THE HERMATYPIC CORAL MONTIPORA VERRUCOSA,

Hawaii Inst. of Marine Biology, Honolulu.
S. L. Coles, and P. L. Jokiel.

Marine Biology, Vol 49, No 3, p 187-195, 1978. 2 fig, 6 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, *Salinity, *Light, Coral, Light intensity, Growth rates, Mortality, Interactions, Synergistic effects.

Colonies of Montipora verrucosa were acclimated to salinities of 20, 25, 30, 35 or 40% for 24 hours at normal ambient sea water temperatures of 23 to 27C and then exposed to rising temperatures at the rate of 0.5C/hour. In a second experiment, corals were exposed to varying intensities of light and temperature. It was found that temperature tolerance is affected by both light and salinity. At high temperatures, the ability of the coral to survive or resist damage is reduced by low salinities and high light intensities. In long-term growth investigations at both upper and lower sublethal temperatures, high light intensity resulted in substantial loss of zooxanthellar pigment, higher mortality rates, reduced carbon fixation and lowered growth rates. It was concluded that response of corals to a given ecological factor must vary with changes in other environmental parameters, and that these interactions are most important near the limits of tolerance for a given parameter. (Chilton-ORNL)
W79-06496

SIZE VARIATION AND THE DISTRIBUTION OF HEMIMETABOLOUS AQUATIC INSECTS: TWO THERMAL EQUILIBRIUM HYPOTHESES,

Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
B. W. Sweeney, and R. L. Vannote.

Science, Vol 200, No 4340, p 444-446, April 1978. 1 fig, 2 tab, 20 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Aquatic insects, Growth rates, Larval growth stage, Mature growth stage, Size, Fecundity.

Two hypotheses are formulated concerning the importance of temperature to both size and geographical distribution of hemimetabolous aquatic insects. These hypotheses are based on laboratory data which suggest that modifying the optimum temperature regime by rearing insects in warmer or cooler environments affects the bioenergetic and developmental aspects of larval growth and results in lower individual adult weight and fecundity. It is suggested that these results may be critical to evaluating the affects of thermal pollution since warming the seasonal cycles of a river by 2 or 3C might eliminate species by affecting body size and fecundity. It was concluded that a geographically uniform set of data on larval growth rate, adult size, and fecundity for several species of aquatic insects is needed to test and refine the hypotheses. (Chilton-ORNL)
W79-06497

MICROSETELLA NORVEGICA (BOECK): A DIRECT RELATIONSHIP BETWEEN SEASONAL SEA TEMPERATURE AND ADULT SIZE IN A PLANKTONIC COPEPOD,

Newcastle-upon-Tyne Univ. (England). Dove Marine Lab.
F. Evans, and W. Diaz.

Crustaceana, Vol 34, No 3, p 313-315, 1978. 1 fig, 12 ref.

Descriptors: *Environmental effects, *Temperature, Size, Seasonal, Copepods.

The data presented indicate that, in contrast to information available on other copepods, Microstella norvegica is larger in summer than in spring and that its size is directly related to the sea temperature. No explanation of this divergence from the usual pattern of seasonal size in planktonic copepods is given. (Chilton-ORNL)
W79-06498

INTERSPECIFIC AND SEASONAL DIFFERENCES IN THE TEMPERATURE TOLERANCE OF STREAM FISH,

State Univ. of New York Coll. at Buffalo. Dept. of Biology.
K. T. Kowalski, J. P. Schubauer, C. L. Scott, and J. R. Spotila.

Journal of Thermal Biology, Vol 3, No 3, p 105-108, July 1978. 4 fig, 1 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Resistance, Seasonal, Adaptation, Thermal stress, Acclimation.

Interspecific differences in temperature tolerances (CTM) of 13 species of stream fish acclimated to constant temperature (15.0C) and photoperiod (LD 12:12) are reported. Three of these species exhibited seasonal differences in CTM despite acclimation to constant laboratory conditions. Highest CTM was shown by Notropis stramineus at 33.1C. Lowest CTM's were shown by Hypentelium nigricans at 30.8C, Cottus bairdi at 30.9C, and Nocomis micropogon at 30.9C. It was suggested that while CTM is not a precise determinant of the temperature tolerance of fish, it is an indicator of the temperature tolerance and can be used in thermal ecology studies as a measure of the ability of fish to acclimate to changes in temperature. (Chilton-ORNL)
W79-06499

THE BIOLOGY OF THE MARINE SPONGE MICROCIONA PROLIFERA (ELLIS AND SOLANDER). III. SPICULE SECRETION AND THE EFFECT OF TEMPERATURE ON SPICULE SIZE,

Hartford Univ., CT. Dept. of Biology.
T. L. Simpson.

Journal of Experimental Marine Biology and Ecology, Vol 35, No 1, p 31-42, 1978. 10 fig, 2 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Aquatic animals, Growth rates, Sponges.

The deposition of silicon in Microciona prolifera is a diversified phenomenon involving a number of different processes with each of three major spicule types being secreted in a different fashion. In these studies, a clear relationship was shown between temperature and silicon deposition. The production of thicker spicules at lower temperatures suggest that the entrapment of transported silicon at the site of polymerization is more efficient at lower temperatures. During the growing season for this intertidal sponge water temperatures generally increase from about 14 to 23C and then decrease to about 16C with the result that spicule secretion within new growth areas is at different temperatures and a range of spicule thickness is seen. Little correlation between spicule length and temperature was found in these studies. (Chilton-ORNL)
W79-06500

5D. Waste Treatment Processes

CLEANING CONTAMINATED GROUND WATER.
Ground Water Age, Vol 13, No 4, p 28-30, December, 1978.

Descriptors: *Water pollution treatment, *Activated carbon, Groundwater barriers, Chemical warfare, Organic pesticides, Colorado, Rocky Mountain Arsenal.

Ground water contamination at the Rocky Mountain Arsenal near Denver, Colorado is being contained by a 1500-foot long underground water barrier and treated with a granular activated carbon system. The treated water is returned to the aquifer on the downstream side of the barrier through a dozen recharge wells. The treatment system's modular design allows for expansion to handle higher flow rates and more stringent water quality requirements in the future. Granular activated carbon's 'broad spectrum' treatment capability provides additional protection against the possible appearance of other dissolved organic contaminants in the ground water. Monitoring wells on both sides of the barrier will keep track of ground water quality and depth. Seasonal variations and changes due modifications in the operation of the treatment system will be studied. This pilot containment/treatment system will provide data needed to design and construct a permanent solution to the problem of contaminated ground water at the Rocky Mountain Arsenal. The techniques employed there will make a significant contribution toward the development of a practical technology for combating ground water contamination. (Purdin-NWWA)
W79-06003

EXPERIMENTS AIMED AT THE REMOVAL OF PHOSPHATE BY ELECTROCHEMICAL METHODS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
E. Dobolyi.
Water Research, Vol 12, No 12, p 1113-1116, 1978. 1 fig, 3 tab, 8 ref.

Descriptors: *Nutrient removal, *Electrochemistry, *Electrolysis, *Phosphates, *Aluminum, *Sewage treatment, Water pollution control, Chemical precipitation, Waste water treatment, Limiting factors, Hydrogen ion concentration, Phosphorus, Nutrients, Research equipment.

Electrochemical dissolution of aluminum is more efficient in removing phosphate from an experimental solution and from sewage than chemical precipitation with an aluminum sulfate solution containing an equal amount of aluminum, if the molar ratio of aluminum to phosphorus is greater than about 1.6. A probably explanation for the higher efficiency of electrolytically produced aluminum ions is that they de-chelate nascent aluminum, as opposed to aqueous solutions where aluminum is already present in the sulfate. In the experiments an electrolysis cell with separated electrode compartments was used to measure in different electrolyte solutions the amount of aluminum dissolved electrochemically in the anolyte by one A current during one min. This was 10-20% greater than that predicted by Faraday's law. The cathode was dissolved chemically, based on alkalinization of the electrolyte in the cathode compartment of the divided cell; the process was unaffected by the current intensity. Sheet aluminum of one mm thickness and 99.99% purity was used for the electodes. Equipment consisted of Plexiglas electrolysis cells, with each compartment having a volume of 1600 cu cm. Four sintered glass filters of G4 pore size separated compartments. Each electrode was submerged to an area of 88 sq cm, and a laboratory stirrer was operated in each compartment. (Lynch-Wisconsin)
W79-06033

ACUTE LETHALITY OF WASTEWATER DISINFECTION ALTERNATIVES TO JUVENILE RAINBOW TROUT (SALMO GAIRDNERI),
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
V. W. Cairns, and K. Conn.
Research Report No. 92, 1979. 38 p, 4 fig, 10 tab, 22 ref.

Descriptors: *Disinfection, *Chlorination, *Ozone, *Ultraviolet radiation, *Bioassay, Rainbow trout, Dechlorination, Toxicity, Mortality, Waste water treatment, Municipal wastes.

Ninety-six-hour, continuous flow, juvenile rainbow trout bioassays were used to compare the toxicity of secondary municipal effluent before and after disinfection with chlorine, chlorine dioxide, ozone, and ultraviolet light. Non-disinfected secondary effluent was non-acutely lethal in 15 of 17 trials. Ozonated waste water was non-acutely lethal in five of six trials and effluent treated with ultraviolet light was non-acutely lethal in both trials conducted. Mechanical upsets in the treatment systems were responsible for mortalities in the non-disinfected and ozonated effluent trials. The 96-hr LC50's for chlorinated waste water ranged from 0.01-0.09 mg/liter and averaged 0.04 mg/liter as total residual chlorine while chlorine dioxide doses greater than 1 mg/liter produced acute lethality in 96 hrs. Chlorinated effluent was found more toxic than chlorine dioxide disinfection; both disinfected waste waters were non-acutely lethal after dechlorination with sodium sulfite or 24 hrs storage. (Lisk-Firl)
W79-06040

EVALUATION OF HIGH PERFORMANCE LIQUID CHROMATOGRAPHY PACKINGS FOR THE CONCENTRATION AND SEPARATION OF ORGANIC MATERIALS IN WATER,
American Univ., Washington, DC. Dept. of Chemistry.
A. Welebir, W. M. d'Angelo, S. W. Bigelow, and M. H. Aldridge.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 652, Price codes: A03 in paper copy, A01 in microfiche. Progress Report, November 28, 1977. 40 p, 7 fig, 5 tab, 44 ref. N00 173-76-C-0183.

Descriptors: *Waste water treatment, *Oil wastes, *Adsorption, *Gas chromatography, *Analytical techniques, Organic compounds, Separation techniques, Water purification, Water treatment, Aqueous solutions, Sea water, Saline water, Biodegradation, Pseudomonas.

The polymeric adsorbent amberlite XAD-4, a copolymer of styrene and divinyl benzene, was studied to determine its efficiency for extracting the dissolved oily wastes from sea water. The purification process required by the XAD-4 material is described. Standards were prepared in distilled water, synthetic sea water, and natural sea water. The adsorption efficiency of the standards from the aqueous solutions was determined by analyzing the solutions with liquid chromatography and aliphatic concentrations by an infrared technique before and after passage through the XAD-4 material. Retention efficiencies of 86 to 88% were obtained. The effects of flow rate, sample size and the weight of XAD-4 on retention efficiency are discussed. In a study for biodegradation by pseudomonas, naphthalene and beta naphthylamine were found to be biodegradable using a qualitative comparative gas chromatographic technique. Both compounds showed end products having the same retention times, suggesting similar mechanisms. Beta-naphthylamine's low biodegradation rate was attributed to the formation of an intermediate which accumulated in solution--the rate determining step. It is concluded that XAD-4 is an excellent trapping agent for trace amounts of organic compounds in water. (Davison-IPA)
W79-06096

WASTEWATER TREATMENT FOR REUSE AND ITS CONTRIBUTION TO WATER SUPPLIES,
District Columbia Dept. of Environmental Services, Washington.
H. P. Warner, and J. N. English.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 145, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/2-78-027, March 1978. 50 p, 7 fig, 20 tab, 11 ref. 68-03-0344.

Descriptors: *Water reuse, *Waste water treatment, *Pilot plants, *Treatment facilities, Potable water, Microorganisms, Organic compounds, Heavy metals, Inorganic compounds, Pesticides, Effluents, Water purification, Water purity, Water quality, Sampling, Radioactivity, Water pollution, Pollutant identification, Water pollution treatment.

The evaluation of a combined biological/physical-chemical pilot treatment system designed to produce a high quality reusable water is summarized. The 18 month study conducted at the EPA/Washington, D. C. Blue Plains Pilot Plant had as objectives: the identification of specific pollutants in the final effluent; an evaluation of individual process performances in removing these pollutants; and the provision of data concerning process and system variability and reliability regarding pollutant removals. Performance results showed the absence of virus in the effluent; concentrations of radioactivity, trihalomethanes and other volatile organics, heavy metals, pesticides, TOC, turbidity, and microbiological constituents were similar to those found in finished drinking waters during the EPA National Organics Reconnaissance Survey in 1975. Specific organic compounds identified in the effluent are also found in finished drinking waters. Result of an 80 element survey did not detect significant quantities of any hazardous inorganic material, and mutagenic properties were not exhibited in effluent organic concentrates. Endotoxin levels were found to be comparable to those of public drinking water supplies. The frequency distribution of the day to day concentrations of chemical, physical, and biological materials remaining in the effluent demonstrated treatment reliability. (Davison-IPA)
W79-06097

EFFECT OF ILLUVIATED DEPOSITS ON INFILTRATION RATES AND DENITRIFICATION DURING SEWAGE EFFLUENT RECHARGE,
Arizona Univ., Tucson. School of Renewable Natural Resources.
R. A. Herbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 669, Price codes: A05 in paper copy, A01 in microfiche. Master of Science thesis, 1976. 71 p, 15 fig, 43 ref, 2 append. OWRT A-999-ARIZ(5), 14-34-0001-6003.

Descriptors: *Sewage effluents, *Denitrification, *Infiltration rates, *Recharge, *Ephemeral streams, Sewage, Nitrogen, Groundwater, Sewage disposal, Waste disposal, Sewage treatment, Arizona, Nitrates.

Ephemeral stream channels are used by some southwestern communities for disposal of sewage effluent. One of these communities is Tucson, Arizona. A column study was conducted to determine the interrelationships among nitrogen transformations, infiltration rates, and development of a black layer during sewage effluent recharge. Experiments included the packing of columns with river sand and continuously flooding them with sewage effluent. Infiltration rates and manometer readings were recorded daily and samples of inflow and outflow were collected and analyzed for the various nitrogen compounds. The results are presented. Infiltration rates decreased rapidly upon application of sewage. A black layer developed within a few days, the thickness of which was inversely related to the infiltration rate. There was no apparent relationship between black layer development and reduction in total nitrogen, but most of the nitrogen was in the wrong form for denitrification, making this part of the results inconclusive. The percent of total nitrogen removal was greater for lower infiltration rates. (Jamail-Arizona)
W79-06107

THEORY OF CLARIFIER OPERATION. I. QUIESCENT-HINDERED SETTLING OF FLOCCULATING SLURRIES,
Associated Water and Air Resources Engineers Inc., Nashville, TN.
J. H. Clarke, A. N. Clarke, and D. J. Wilson.
Separation Science and Technology, Vol. 13, No. 9, p 767-789, 1978. 9 fig, 51 ref, 7 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Simulation, Flocculation, Separation techniques, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Theoretical analysis, Computer models, Model studies.

The operation of quiescent (batch) clarifiers operating in the Class III mode (hindered settling) with flocculating slurries is simulated by a set of nonlinear partial differential equations, the continuity equations for the individual species of particles. The mathematical model predicts the expected response of the system to variation in input parameters (particle density, viscosity, particle size, clarifier height, percent solids, particle size distribution, and particle disruption rates). Disintegration of the larger particles by viscous drag forces is assumed to be first-order. The equations are integrated numerically for the case of batch settling, and the dependence of settling characteristics on the parameters of the model is studied. (See also W79-06113 and W79-06114) (Witt-IPC)
W79-06112

THEORY OF CLARIFIER OPERATION. II. HINDERED SETTLING OF FLOCCULATING SYSTEMS IN RECTANGULAR CLARIFIERS,
Vanderbilt Univ., Nashville, TN.
D. J. Wilson.
Separation Science and Technology, Vol. 13, No. 10, p 881-893, 1978. 2 fig, 3 ref, 6 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Simulation, Flocculation, Separation technique, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Model studies, Theoretical analysis, Computer models.

A mathematical model is presented for describing the steady-state operation of rectangular clarifiers. The model permits the examination of hindered settling of solids which are undergoing flocculation and floc disruption. The steady-state solution requires modest amounts of computer time and also lends itself to the analysis of quiescent settling in jar tests. Assumptions, possible expansions, and limitations of the model are discussed. (See also W79-06112) (Witt-IPC)
W79-06113

THEORY OF CLARIFIER OPERATION. III. SLUDGE BLANKET AND UPFLOW REACTOR-CLARIFIERS,
Vanderbilt Univ., Nashville, TN.
A. N. Clarke, D. J. Wilson, and J. H. Clarke.
Separation Science and Technology, Vol. 13, No. 10, p 895-915, 1978. 19 fig, 4 ref, 1 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Sludge, Flocculation, Separation techniques, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Model studies, Theoretical analysis, Computer models, Design.

The operation of three designs of axially symmetric continuous-flow upflow clarifiers is modeled by means of the continuity equations presented earlier. Class III operations (hindered settling) with flocculating slurries is considered, and the larger particles are permitted to disintegrate under the influence of viscous drag forces by a first-order process. The equations are integrated numerically, and the dependence of clarifier performance on clarifier type and hydraulic loadings is explored. Search applications to the design of clarifiers are suggested. (See also W79-06112) (Witt-IPC)
W79-06114

METHOD FOR RECYCLING PAPER MILL WASTE WATER,
For primary bibliographic entry see Field 3D.
W79-06115

ANALYSIS OF SETTLING BASIN OPERATION IN THE PULP AND PAPER INDUSTRY (METSAETEOLLISUUDEN JAETEVESIEN SELKEYTYSALTAAT),
Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Reaktorilaboratorio.
R. Kuoppamaki, E. Ramo, and K. Passinen.
Paperi ja Puu, Vol. 60, No. 11, p 695-698, 701-702, November, 1978. 8 fig, 1 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Settling basins, *Operation and maintenance, Pulp and paper industry, Waste water treatment, Effluents, Waste treatment, Water pollution treatment, Water pollution sources, Regression analysis, Optimization, Mathematical studies, Basins, Suspended solids.

In attempting to optimize the operation of pulp and paper industry effluent settling basins, prerequisites are the identification of the pertinent parameters and the quantitative determination of their effects on the solids-removal efficiency. A study was conducted to demonstrate the applicability of statistical methods to the analysis of effluent solids sedimentation. Correlation and regression analyses were used to interpret data from regular basin operating reports and time-series data obtained during a period of intensified basin input and output monitoring. The evaluation of regular report data provided information on the average solids-removal efficiency and its long-term variation. The short-interval multiparamete monitoring data led to conclusions regarding the dynamic characteristics of the basin and gave indications of the relative importance of various parameters to the overall efficiency of the process. The approach outlined seems to offer further developmental potential in data-processing and measurement techniques and has practical utility for improving the solids-removal efficiency of settling basins. (Brown-IPC)
W79-06121

EFFLUENT TREATMENT WITH ION-EXCHANGE RESINS (TRATAMENTO DE EFLUENTES POR RESINAS DE TROCA IONICA),
Rohm and Haas Brazil S.A.
A. Nunes de Oliveira.
O Papel, Vol. 39, p 51-58, August, 1978. 13 fig, 5 ref, 4 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Ion exchange, Resins, Wastes, Waste treatment, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Economics, Reliability, Kraft mills.

A review is presented of the potential use of ion-exchange resins, such as Amberlite XAD-8, for the treatment of pulp and paper industry effluents. Data are reviewed showing such treatment to be particularly applicable to kraft pulp mill effluents, giving good economy, reliability, and simplicity of operation. The equipment is of compact modular design. The need to match such treatment systems to the individual requirements of a mill is emphasized. (Speckhard-IPC)
W79-06122

A REVIEW OF INDUSTRY EXPERIENCE WITH SELECTED INTERNAL PROCESS SOLIDS SEPARATION DEVICES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
For primary bibliographic entry see Field 3E.
W79-06123

WATER OF (PAPETERIES DE) VIRGINAL (LES EAUX PROPRES DE VIRGINAL),
C. Platier.
La Papeterie, Vol. 100, No. 11, p 455-456, 458-459, November, 1978. 4 fig, 4 illus.

Descriptors: *Pulp wastes, *Waste water treatment, *Water treatment, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Foreign countries, Belgium, Flocculation, Filtration, Sands, Biological treatment, Europe, Waste treatment, Water purification, Treatment facilities, Chemical precipitation.

The process-water and waste-water treatment facilities at a Belgian coated-paper mill, which used 11,000 cu m of water per day, are described. The incoming water is purified by both flocculation and sand filtration. Effluent treatment includes primary flocculation-type clarification and Attisholz-system biological treatment. (Speckhard-IPC)
W79-06124

STUDIES OF FLOCCULATION AND SEDIMENTATION TREATMENT OF PULP MILL EFFLUENT. (PART 2). AN APPROACH OF A CLOSED SYSTEM USING ETTRINGITE COMPOUNDS, (IN JAPANESE),
Oji Paper Col. Ltd., Tokyo (Japan).
T. Horikoshi, O. Ebinuma, Y. Kita, and H. Ishikawa.
Japan Tappi, Vol. 32, No. 9, p 541-547, September, 1978. 8 fig, 9 ref, 2 tab. English summary.

Descriptors: *Pulp wastes, *Waste water treatment, *Flocculation, *Sedimentation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Calcium hydroxide, Hydrogen ion concentration, Chemical oxygen demand, Lime, Sludge, Silica, Chemical precipitation, Aluminum sulfate, Closed system, Ettringite.

Treatment of pulp mill effluents with Ettringite (prepared by reacting aluminum sulfate with calcium hydroxide at pH 11 or higher) removed COD better than did alum and massive lime dosing. The resulting sedimentation sludge could be used in a closed-system operation. Changes of Ettringite compounds in this closed system were elucidated by x-ray analysis. Interferences by other compounds, such as silica and magnesium oxide, affect the operation of the closed system, and they should be removed. (See also W79-01758) (Brown-IPC)
W79-06127

STUDY OF SULFATE PULP MILL EFFLUENT TOXICITY (ESTUDIO DE LA TOXICIDAD DE LOS EFLUENTES DE UNA FABRICA DE PASTA AL SULFATO),
For primary bibliographic entry see Field 5C.
W79-06128

GENERAL ASPECTS OF WATER POLLUTION BY THE PULP AND PAPER INDUSTRY (ASPECTOS GENERALES DE LA CONTAMIN-

ACION DEL AGUA POR LA INDUSTRIA DE PULPA Y PAPEL),
For primary bibliographic entry see Field 5C.
W79-06130

TREATMENT OF PAPERMAKING EFFLUENTS (TRAITEMENT D'EFFLUENTS DE PAPETERIES),
Societe Rhone Poulenc Textile Progil (France).
B. Ancelle, and S. Lambert.
French Patent No. 2,351,063. Issued December 9, 1977. 8 p. 8 claims.

Descriptors: *Patents, *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Waste treatment, Water pollution treatment, Water pollution sources, Bleaching wastes, Flocculation, Ultrafiltration.

A process for treating pulp mill effluents (especially bleach plant effluents) involves addition of a flocculant at a level below that required for proper flocculation and then subjecting the mixture to ultrafiltration. (Speckhard-IPC)
W79-06131

EXPERIMENTAL DECOLORATION OF WASTE WATERS FROM SOFTWOOD KRAFT PULP PRODUCTION (CERCETARI PRIVIND DECOLORAREA APELOR REZIDUALE PROVENITE DE LA FABRICAREA CELULOZEI SULFAT DIN RASINOASE),
M. Puiu, M. Bolohan, and R. Turchevici.
Celuloza si Hirtie, Vol 27, No 2, p 60-68, April/June, 1978. 12 fig, 6 ref, 6 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Decoloration, *Chemical precipitation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Color, Aluminum sulfate, Aluminum chloride, Calcium hydroxide, Iron sulfate, Iron chloride, Activated carbon, Lime, Costs, Sludge, Coagulation, Separation techniques, Softwood, Kraft mills.

Among several chemical coagulants investigated in a kraft mill (5% solutions of calcium hydroxide, aluminum sulfate, aluminum chloride, ferric chloride, and ferrous sulfate, as well as activated carbon), the lime treatment was found to give the best results with regard to cost and ease of filtration of the resulting sludge precipitate. (Brown-IPC)
W79-06134

COLOR REMOVAL FROM PULP MILL EFFLUENT USING FLY ASH ACIDIFIED WITH CHLORINATION STAGE EFFLUENT,
Saskatchewan Univ., Saskatoon.
D. N. Rao, N. N. Bakhshi, and D. G. MacDonald.
Canadian Pulp and Paper Association, Transactions of the Technical Section, Vol 4, No 3, p TR77-TR82, September, 1978. 5 fig, 6 ref, 5 tab.

Descriptors: *Decoloration, *Pulp wastes, *Waste water treatment, *Fly ash, *Bleaching wastes, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Aluminum, Iron, Calcium, Ions, Color, Chemical oxygen demand, Hydrogen ion concentration.

Aluminum, iron, and calcium ions are released from fly ash by acidification with the chlorination-stage effluent from a kraft bleach plant. The resulting slurry effectively removes the color from the caustic extraction-stage effluent. One gram of fly ash requires 157 ml of the chlorination-stage effluent to release the maximum amount of metal ions. Treatment of one liter of caustic extraction-stage effluent (color of 36,600 APHA units, COD of 4,220 ppm) with 2.3 g of fly ash acidified with 3.6 liters of chlorination-stage effluent (color of 650 APHA units, COD of 765 ppm) resulted in 93% color and 73% COD removals. The optimum pH for color removal is approximately 4.6. Acidification of fly ash with chlorination-stage effluent is not as effective as with HCl because the effluent pH of 1.64 is not low enough and the dissolved organic compounds in the effluent react with the metal ions. The mechanism of color removal and the behavior of the sludge obtained by this treatment are also briefly discussed. (Swichtenberg-IPC)
W79-06135

AERATED LAGOON TREATMENT OF BLEACHED KRAFT MILL EFFLUENTS AT HIGH TEMPERATURE,
British Columbia Research Council, Vancouver.
E. G.-H. Lee, J. C. Mueller, and C. C. Walden.
Canadian Pulp and Paper Association, Transactions of the Technical Section, Vol. 4, No. 1, p TR15-TR18, March, 1978. 4 fig, 12 ref, 6 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Aerated lagoons, *Temperature, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Biochemical oxygen demand, Toxicity, Lagoons, Suspended solids, Sludge, Pulp and paper industry, Effluents, Kraft mills.

Laboratory studies suggest that aerated lagoons for treating bleached kraft mill effluents perform satisfactorily up to about 45-50 C. Five-day BOD removal and detoxification efficiency begin to drop when temperatures exceed 50 C. The tendency of mixed liquor suspended solids (biomass) to disperse also increases at temperatures above 50 C, resulting in poor sludge settleability, sludge washout, and high suspended solids levels in effluents. (Switchenberg-IPC)
W79-06136

UTILIZATION OF SPENT SULFITE LIQUOR BY PEKILO FERMENTATION AND ULTRAFILTRATION,
Finnish Pulp and Paper Research Inst., Helsinki.
K. Forss, R. Kokkonen, H. Sirelius, and P.-E. Sagfors.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 97-102. 11 fig, 3 ref.

Descriptors: *Sulfite liquors, *Waste water treatment, *Ultrafiltration, *Fermentation, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Waste treatment, Foreign countries, Europe, Lignins, Lignosulfonates, Industrial water, Proteins.

Protein can be produced from spent sulfite pulping liquors by means of the Pekilo process. A study has been made of the interaction of the Pekilo process with the ultrafiltration process to find possible advantages of their simultaneous application. The results show that fermentation of spent sulfite liquor prior to ultrafiltration permits a reduction in the size of the ultrafiltration installation needed for production of high molecular-weight lignosulfonates, and also diminishes the requirement of wash water, producing a filtrate which is suitable for concentration by hyperfiltration. (Swichtenberg-IPC)
W79-06137

BIOLOGICAL CONTROL ALTERNATIVES FOR A SULFITE MILL (EFFLUENT),
Finnish Pulp and Paper Research Inst., Helsinki.
E. Meloni.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 81-86. 4 fig, 7 ref, 4 tab.

Descriptors: *Sulfite liquors, *Biological treatment, *Waste water treatment, Pulp wastes, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Europe, Yeasts, Candida utilis, Proteins, Alcohols, Biochemical oxygen demand, Phosphorus compounds, Nitrogen compounds, Capital costs, Operating costs, Costs, Waste treatment, Water pollution control, Finland, Condensates, Sulfite pulp mill, Ethanol, Sulfite alcohol.

Biological treatment and the manufacture of ethanol, Torula (Candida utilis) yeast, or Pekilo protein were evaluated as alternative methods for the pollution control of evaporator condensates from a sulfite pulp mill. All of these processes, with the exception of alcohol manufacture, reduce the organic matter (BOD) discharged from the mill, but increase the discharge of phosphorus and nitrogen. Although biological effluent treatment involves the lowest capital and operating cost, it remains the most expensive alternative, since the other methods yield a saleable product. (Swichtenberg-IPC)
W79-06138

PILOT PLANT STUDIES OF BIOLOGICAL TREATMENT OF MAGNESIUM-BASE SULFITE MILL EFFLUENT--AERATED STABILIZATION BASIN AND ROTATING BIOLOGICAL SURFACE,
Ontario-Minnesota Pulp and Paper Co., Ltd., Fort Frances.
C. D. Baker, R. H. Nachbar, and R. E. Summer.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 69-80. 4 fig, 12 ref, 3 tab.

Descriptors: *Sulfite liquors, *Waste water treatment, *Biological treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp wastes, Pulp and paper industry, Effluents, Foreign countries, Canada, Biochemical oxygen demand, Aerated lagoons, Oxidation lagoons, Nutrients, Suspended solids, Sludge, Lagoons, Newsprint mills, Spent sulfite liquor, Rotating biological contactor.

Magnesium-base spent sulfite liquor (SSL) was pretreated with aqueous ammonia and phosphoric acid and biologically treated in an aerated stabilization basin (ASB) at loadings of 4 and 12 lb BOD/1000 cu ft/day for retention periods of 20 and 7 days, respectively. This 2-yr study was carried out at a Canadian integrated newsprint mill during both summer and winter months. BOD reductions were satisfactory. The influence of nutrients on BOD reduction was determined. Basin suspended solids were higher at the shorter residence time. Column settleability tests showed that about 50% of the effluent solids were readily settleable but upflow rates less than 625 gal/day-ft would be needed to remove most of the solids. Filter leaf tests revealed that the settled solids would be difficult to dewater on a vacuum filter. It was concluded that BOD reduction in an ASB is feasible but solids clarification and sludge dewatering make the process impractical. Similar studies on the BOD reduction of SSL were conducted with a rotating biological contactor (RBC). Although BOD reductions of over 80% were achieved on occasion, the overall performance of the unit was erratic. Because the unit had an integral clarifier, sludge settleability was not adequately characterized. The settled sludge showed wide variations in its characteristics. The RBC performance was very sensitive to fluctuations in feed properties. (Swichtenberg-IPC)
W79-06139

ASSESSMENT OF THE ABILITY OF BIOLOGICAL TREATMENT TO DETOXIFY EFFLUENTS FROM SULFITE MILLS PRACTICING CHEMICAL RECOVERY,
Beak Consultants Ltd., Montreal (Quebec).
S. Schneiderman, and G. A. Allard.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 49-58. 12 ref, 16 tab.

Descriptors: *Pulp wastes, *Sulfite liquors, *Waste water treatment, *Biological treatment, Detoxifica-

tion, Wastes, Industrial wastes, Water pollution treatment, Toxicity, Water pollution sources, Waste treatment, Pulp and paper industry, Effluents, Activated sludge, Aerated lagoons, Biochemical oxygen demand, Operation and maintenance, Design, United States, Chemical recovery, Spills, Sulfite pulp mills.

According to a survey of seven U.S. sulfite pulp mills, aerated lagoon systems and activated sludge treatment are capable of effluent detoxification irrespective of the form of chemical recovery. Four of the 7 treatment systems detoxified irrespective of the form of chemical recovery. Four of the 7 treatment systems detoxified 100% of the time; the remaining 3 mills exhibited lesser degrees of detoxification frequency. BOD removal was generally good, ranging from 73 to 91%, except at two mills where the BOD removals were 45 and 60%. Proper design and operation and frequency and duration of liquor spill strongly affect the ability of biological treatment to detoxify sulfite mill effluents. No consistent relationship was found between pulping base or wood species and detoxification. (Swichtenberg-IPC)
W79-06140

PURIFICATION OF HIGH-ASH WASTEWATERS IN FLOTATION SAVEALLS (OCHISTKA VYSOKOZOL'NYKH STOCHNYKH VOD NA FLOTATSIONNYKH LOVUSHKAKH),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
V. A. Kopylov.
Bumazhnaya Promyshlennost', No. 10, p 28-29, October, 1978. 2 fig, 1 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Flotation, Wastes, Pulp wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Aeration, Water purification, Suspended solids, White water(Paper machines), Savealls, Aluminum oxide, Polyacrylamide, Rosin.

A study of ways to increase the efficiency of flotation savealls, so that they can be used for treatment of white water from the manufacture of high-ash content papers, showed that the air can be utilized more effectively when the tank inlet is located tangentially near its bottom; the height of the head tank should not exceed 10-12 m. A further increase of saveall efficiency can be achieved by the addition of chemical agents (aluminum oxide, polyacrylamide, and rosin size) in doses depending on the suspended solids content. With a combination of these chemicals, a degree of purification of up to 99% was obtained for effluent containing up to 4,800 mg/liter of suspended solids. (Stapinski-IPC)
W79-06142

OXIDATIVE TREATMENT OF INDUSTRIAL WASTEWATER,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
F. Ellerbusch, and H. S. Skovronek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 268, Price codes: A02 in paper copy, A01 in microfiche. Technical Report EPA-600/J-77-057. 1977. 9 p, 7 fig, 3 tab, 55 ref.

Descriptors: *Industrial wastes, *Oxidation, *Waste treatment, *Performance, *Costs, Oxidation lagoons, Activated sludge, Incineration, Aerated lagoons, Ozone, Electrolysis.

Oxidative industrial waste treatment processes are defined, categorized, and discussed. Biological, chemical, and thermal methods, categorized as oxidative destruction, reductive destruction, and nondestructive, separation processes, are considered. Advantages, disadvantages, and generalized cost comparisons are presented. Energy use or production is also considered. US Environmental Protection Agency projects are identified as examples. Some systems discussed include activated sludge, sludge incineration, multiple oxidation channels, oxidation pond, aerated lagoon, and the PACT system. Ozone treatment of electroplating wastes, alkaline oxidation pulping, and electrolytic oxidation of plating wastes, are outlined. (Small-FIRL)
W79-06144

PROCESSING RAW SEWAGE BY ULTRAFILTRATION,
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
L. R. Harris, and C. M. Adema.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 607, Price codes: A02 in paper copy, A01 in microfiche. Report MAT-77-79. April 1977. 15 p, 2 fig, 5 tab, 25 ref.

Descriptors: *Filtration, *Membranes, *Membrane processes, *Sewage effluents, *Water quality standards, Water pollution, Waste water treatment, Waste water disposal, Suspended solids, Coliforms.

Four filtration configurations were evaluated for the treatment of raw sewage to produce effluent which meets discharge regulations for marine sanitation devices. One microfiltration unit and nine ultrafiltration systems were operated and four filtration configurations were tested: tubular, hollow fiber, spiral wound, and plate and frame. Pretreatment and cleaning requirements for each system were assessed. Parameters evaluated for each system included relative flux decline, maintenance, rejection of fecal coliforms, and removal of suspended solids. The 1980 effluent discharge standard requires that waste water contain <150 mg/liter of suspended solids and <200 fecal coliform bacteria per 100 ml. All the systems investigated produced an effluent which met the suspended solids limitations and all but two systems produced effluent that met the coliform requirements. Further research with non-cellulosic tubular membranes with a 1-inch interior diameter and with hollow fiber membranes in conjunction with a biological oxidation system was recommended. Comparison of these systems with a plate and membrane design was also suggested. (Lisk-FIRL)
W79-06146

CONTROL OF VIRUS PATHOGENS IN MUNICIPAL WASTEWATER AND RESIDUALS BY IRRADIATION WITH HIGH ENERGY ELECTRONS,
New Hampshire Univ., Durham. Dept. of Microbiology.
T. G. Metcalf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 347, Price codes: A04 in paper copy, A01 in microfiche. 1977. 64 p, 18 fig, 2 tab, 19 ref.

Descriptors: *Radiation, *Waste water treatment, *Disinfection, *Viruses, *Sewage treatment, Performance, Seasonal, Water pollution.

Electron radiation was used to disinfect waste water based on inactivation of enteric viruses. Trials with an in-line installed radiation unit at the city of Boston's Municipal Waste Treatment Plant on Deer Island confirmed results obtained at the High Voltage Research Laboratory, MIT. Radiation doses needed for disinfection were calculated from D(10) values determined for test enteric viruses and natural virus numbers found per unit volume of a vwaste water residual. Disinfection of fresh raw sewage was estimated to require at least 400 kilorads/ml doses. As much as 600 kilorads/ml may be required during the summer months, based on peak concentrations of 1000 PFU/ml. Disinfection of waste water effluents was estimated to require a maximum of 400 kilrads/gal. Acid adjustment of a residual pH 3.7 or addition of aluminum or ferric chlorides, enhanced radiation effectiveness. Also, a method was developed for recovery of test virus from large volumes of digested sludge which permitted recoveries of 50% of test virus incorporated into five gal samples. (Small-Firl)
W79-06148

ALUM ADDITION AND STEP-FEED STUDIE IN OXYGEN-ACTIVATED SLUDGE,
Department of Environmental Services, Washington, DC.
D. F. Bishop, J. A. Heidman, R. C. Brenner, and B. Stamberg.
Available from the National Technical Informatic Service, Springfield, VA 22161 as PB-272 89 Price codes: A03 in paper copy, A01 in microfich Report EPA-600/2-77-166, 1977. 31 p, 6 fig, 10 ta 10 ref.

Descriptors: *Activated sludge, *Oxygen requir ments, *Performance, *Suspended solids, *Pho phorus, Lime, Municipal wastes, Sludge treatmen

A plug flow, oxygen-activated sludge process wa operated with alum addition to remove phosphor and with lime addition to prevent the process p from decreasing below 6.4. The pollutant remova from the primary effluent ranged from 82 to 92 for BOD (7.4 to 19 mg/liter of residual BOD from 52 to 84% for suspended solids (17 to 56 mg liter of residual suspended solids), and from 54 t 86% for phosphorus (1.05 to 3.26 mg/liter of resid ual P). Optimum P removal occurred at a 1.8 to average Al/P ratio with an average total residual of 1.05 mg/liter. In the second phase of the study the oxygen-activated sludge process was operate in a step-feed configuration consisting of a sludg oxygenation stage followed by three stages o oxygen aeration with equal portions of the primar effluent fed to each stage. The step configuratio clearly reduced the solids loading to the clarifie and provided an average process MLSS of mor than 6500 mg/liter. Excellent BOD removal wa realized with the step operation. Eighty-nine per cent removal from the primary effluent resulte with an effluent BOD of 10 mg/liter and a solubl filtered effluent of less than 3 mg/liter. The COI and suspended solids residual averaged 43 mg/lite and 23 mg/liter, respectively. Oxygen usage in th step configuration was significantly less than th 90% typically achieved in co-current contacting (Small-FIRL)
W79-06149

ACTIVATED CARBON TREATMENT O KRAFT BLEACHING EFFLUENTS,
Saint Regie Paper Co., Cantonment, FL.
E. W. Lang, J. W. Stephens, and R. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 078 Price codes: A04 in Paper copy: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-119, 1977. 54 p, 12 fig, 6 tab, 12 ref, append

Descriptors: *Pilot plants, *Activated carbon, *Color, *Organic matter, *Bleaching wastes, Pulp and paper industry, Pulp wastes, Costs, Performance, Adsorption.

A pilot plant study investigated the removal o color and organic contaminants from kraft pulp bleaching plant effluent by adsorption in activated carbon. The caustic bleach effluent, which contains 80% of the color from pulp bleaching, was decolorized when pH was adjusted to 2.5. The spent carbon could be regenerated with caustic solution for an average of 11 adsorption-regeneration cycles before thermal regeneration was necessary. The pH of feed, feed rate, effluent from bleaching of hardwood and softwood, caustic requirements for regenerating the carbon, and concentration of color in feed, were studied. The process was technically sound. It can remove 94% of the color and 84% of the total organic carbon from caustic bleach effluent from the bleaching of softwood. Capital and operating cost estimates are presented for full-scale plants. Variations in design and their cost effects are discussed. The process is generally more expensive than alternative processes for reducing color such as resin adsorption, ultrafiltration, or bleach sequence modification. (Small-Firl)
W79-06151

POWDERED ACTIVATED CARBON ADDITION AT THE WOODSTOCK WATER POLLUTION CONTROL PLANT,

Gore and Storrie Ltd., Toronto (Ontario).
T. Alkema, and R. Luscombe.
Ministry of the Environment, Ontario Technical Report E.01. 1978. 20 p, 1 fig, 7 tab.

Descriptors: *Activated carbon, *Waste water treatment, *Granules, *Pilot plants, *Performance, Biochemical oxygen demand, Color, Oxidation, Ammonia.

A pilot plant study of the effectiveness of powdered activated carbon (PAC) addition to the secondary treatment section at the Woodstock Water Pollution Control Plant was conducted. PAC was added daily to both plant aeration cells. A sampling and analysis program determined the impact of the PAC addition over an 18 wk period. Good operating results were obtained. No significant improvement in BOD removal was found. PAC had no impact on heavy metal removal. Color removal in the secondary treatment section as much improved with PAC addition. Also, oxidation of NH3-N was improved. This increased ammonia removal which was important at this particular plant because a large percentage of the effluent TOD is normally contributed by the nitrogenous oxygen demand. (Small-Firl)
W79-06152

CHARACTERISTICS OF EFFLUENTS FROM SEPARATE SEPTIC TANKS TREATING GREY WATER AND BLACK WATER FROM THE SAME HOUSE,
Ontario Ministry of the Environmental, Toronto. Pollution Control Branch.
M. Brandes.
Technical Report W 68, 1977. 32 p, 3 fig, 6 tab, 30 ref.

Descriptors: *Waste water treatment, *Septic tanks, *Domestics wastes, Sludge, *Performance, Sewage, Coliforms, Phosphorus, Nitrogen, Soil filters.

The chemical and bacteriological characteristics of septic tank effluents from two separate tanks used by one house for grey water and black water (toilet) treatment were studied for nine months. The household used only phosphorus free detergents. For the grey water septic tank effluent, the concentrations of total phosphorus and total Kjeldahl nitrogen were 1.4 and 11.3 mg/liter, respectively. These values are about 10 times lower than the toilet waste water septic tank effluent. Total and fecal coliform organisms in the grey water septic tank were higher than in the effluent from the toilet septic tank. Grey water levels were 24,000,000 and 1,400,000 ml, respectively. The effect of soil filters on removal of chemical and bacteriological contaminants from the septic tank effluents is discussed. Sludge accumulation rates were determined: 8.3 liters/person/yr for the grey water tank and 65.7 liters/person/yr for the toilet water septic tank. Grey water septic tank cleaning were about 8 to 10 times less frequent than recommended time intervals for normal household septic tanks. (Small-FIRL)
W79-06161

NITRIFICATION OF A SECONDARY MUNICIPAL EFFLUENT USING A ROTATING BIOLOGICAL CONTACTOR,
Ontario Ministry of the Environment, Toronto. Waste Water Treatment Section.
T. Hewitt.
Research Publication 71, 1978. 41 p, 11 fig, 6 tab, 25 ref, 1 append.

Descriptors: *Municipal wastes, *Nitrification, Rotational flow, *Mechanical equipment, Hydraulics, Aerobic bacteria, Oxidation, *Ammonia, *Aerobic treatment, Waste water treatment, Performance.

The feasibility of using the Rotating Biological Contactor (RBC) process for biological nitrification of a non-nitrified, secondary municipal effluent was evaluated. Tests were conducted in both summer and winter in Ontario which established that the RBC process could produce a consistent, well-nitrified effluent. During summer tests, nitrification efficiency decreased as hydraulic loading was increased from 0.8 Imperial gpd/sq ft to 3.2 Imperial gpd/sq ft. A hydraulic loading of 3.2 Imperial gpd/sq ft produced an effluent of 0.77 mg/liter average NH3-N, with 71% of the effluent samples containing less than 1 mg/liter NH3-N. As disc rotational speed increased from 1 rpm to 2 rpm, nitrification efficiency increased. During winter, at constant hydraulic loading, nitrification efficiency decreased as waste water temperature decreased. A hydraulic loading rate of 2.4 Imperial gpd/sq ft produced an effluent of 1.05 mg/liter average NH3-N with 79% of the effluent samples containing less than 2 mg/liter NH3-N. Total recovery of nitrification was limited and recovery time was lengthy after two successive upsets. (Small-FIRL)
W79-06162

THE RELATION OF SOIL CHARACTERISTICS TO THE FAILURE OF DOMESTIC WASTE-WATER DISPOSAL SYSTEMS,
Vermont Univ., Burlington.
F. R. Magdoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 809, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Technical Completion Report, April 1979. 46 p, 11 fig, 11 tab, 26 ref. OWRT A-025-VT(1).

Descriptors: *Waste water disposal, *Septic tanks, Soil clogging, Mound systems, Clay soils.

Laboratory and field experiments were conducted to assess design criteria and performance of mound systems for septic tank effluent disposal on clay soils. Laboratory experiments indicated that the mound fill might clog if high rates of effluent application are used (greater than 3 cm/day) or the height of fill is insufficient to allow for well oxidized conditions near the infiltrative surface of the fill. Thirty centimeters of fill or more appear necessary to reduce the development of clogging. Clogged surfaces could recover infiltrative capacity if they were allowed to rest under aerobic conditions. Field experiments clearly showed the superiority of mound systems to subsurface disposal, especially during wet years. Moisture tension patterns in the fill of mound systems indicated that while during the winter clogging of the infiltrative surface may begin, summer conditions appear to cause a recovery of the infiltrative capacity. At no time was seepage noted around the experimental mound systems.
W79-06165

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES, 1976 NEEDS SURVEY. VOLUME 1,
Environmental Protection Agency, Washington, DC. Office of Water Program Operations.
J. A. Chamblee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 717, Price codes: A05 in paper copy, A01 in microfiche. Report 430/9--76--010, 1977. 62 p, 41 tab, append.

Descriptors: *Costs, *Waste water treatment, *Public utilities, Sewers, Infiltration, Storm runoff, Overflow, Rehabilitation.

Cost estimates are presented for needed publicly-owned waste water treatment facilities as part of a report to Congress. Eight categories are covered: Secondary treatment, Higher than secondary treatment, Correction of infiltration/inflow, Major rehabilitation of sewers, New collector sewers, New interceptor sewers, Control of combined sewer overflow, and Treatment and/or control of stormwaters. EPA's assessment of the need for construction of municipal wastewater treatment facilities to serve 1990 populations is $95.9 billion in categories 1-5, and an additional $54.1 billion for control of stormwaters. The states' estimate for the same needs are $100.4 billion for the first five categories and $57.2 billion for stormwaters control. (See also W79-06324) (Small-FIRL)
W79-06323

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES. VOLUME 2. SUMMARIES OF TECHNICAL DATA CATEGORIES I-IV. 1976 NEEDS SURVEY,
Environmental Protection Agency, Washington, DC. Municipal Construction Div.
J. A. Chamblee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 718, Price codes: A05 in paper copy, A01 in microfiche. Report 430/9--76-011, 1977. 81 p, 8 fig, 26 tab, 2 append.

Descriptors: *Costs, *Waste water treatment, *Public utilities, Sewers, Infiltration, Storm runoff, Overflow, Rehabilitation.

Technical data are presented from the 1976 Needs Survey for Waste Water Treatment Facilities as a supplement to the Cost Estimate Report to Congress. Categories of needs include: Secondary treatment and best practicable waste water treatment technology, More stringent treatment, Infiltration/inflow correction, Sewer system replacement or major rehabilitation, New collectors and appurtenances, New interceptors and appurtenances, Correction of combined sewer overflow, and Treatment and/or control of stormwater. (See also W79-06323) (Small-FIRL)
W79-06324

DEWATERING SEWAGE SLUDGE BY ELECTRO-OSMOSIS. PART 1. BASIC STUDIES,
Electricity Council Research Centre, Capenhurst (England).
J. G. Sunderland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 411, Price codes: A03 in paper copy, A01 in microfiche. Report, 1976. 26 p, 6 fig, 7 tab, 7 ref, 1 append.

Descriptors: *Electro-osmosis, *Sludge treatment, *Dewatering, *Electrodes, *Polymers, Sewage sludge, Design criteria, Performance, Municipal wastes.

The thickening of sewage sludge by electro-osmosis on a continuous basis was found feasible in laboratory-scale experiments. Sewage sludge from an anaerobic digester was used in the study and contained about 3% solids. The types of dewatering apparatuses tested included: a cylindrical cell with horizontal parallel electrodes, a dipped cell configuration, a rotating drum cell, and a moving belt cell. Applied voltage ranged from 10-30 volts at pumping rates which varied from 1.92-11.4 ml/min. Employing a fixed and a moving polymer mesh belt (1 cm/15-20 sec) at pumping rates of 4.0-5.2 ml/hr/sq cm, a final solids content of 26-28% was achieved. Currents applied ranged from 3.0-5.6 amps; power requirements correlated closely with the initial solids content of the sludge. The laboratory experiments indicated there would be no problems with scale-up of the electro-osmosis dewatering procedure. Polymer mesh belts drawn across static vertical cathodes were considered feasible on a commercial-plant scale. (See also W79-06326) (Lisk-FIRL)
W79-06325

DEWATERING SEWAGE SLUDGE BY ELECTRO-OSMOSIS. PART II SCALE-UP DATA,
Electricity Council Research Centre, Capenhurst (England).
D. Ellis, and J. G. Sunderland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 412, Price codes: A02 in paper copy, A01 in microfiche. Report 1977. 25 p, 7 fig, 6 tab, 2 ref.

Descriptors: *Dewatering, *Sewage treatment, *Electro-osmosis, *Performance, *Costs, Electrodes, Design, Biochemical oxygen demand, Chemical oxygen demand, Sanitary engineering.

A project scale rig for the electro-osmotic dewatering of sewage was constructed. The moving belt and vertically disposed electrodes minimize floor area requirements and permit continuous removal

of solids from the electrode surface, eliminating batch operation. The rate of dewatering and hence the current can be maintained essentially constant, at constant voltage. A sewage cake of about 24% solids was achieved, together with effluent low in COD and BOD. Cost comparisons are made between different methods of sludge dewatering. Electrokinetic costs are related to initial solids concentration, and compare favorably with conventional techniques at and above about 8% initial solids. The process is probably not appropriate for the sewage treatment market, although much of the technology is relevant to the dewatering of other materials such as ball clay. (See also W79-06325) (Small-FIRL)
W79-06326

ADVANCED TREATMENT APPROACHES FOR METAL FINISHING WASTEWATERS. PART I,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
H. S. Skovronek, and M. K. Stinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 147, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-600/J-77-056a, 1977. 8 p, 12 fig, 1 tab, 27 ref.

Descriptors: *Industrial wastes, *Metallurgy, *Water pollution sources, *Ion exchange, *Electrolysis, Evaporation, Adsorption, Pilot plants, Chromium, Zinc, Nickel, Copper.

New technologies for the control, recycle, and destruction of water pollutants generated in the electroplating and related industries, are described. Ion exchange, evaporation, cementation, electrolytic processes, advanced chemical techniques, treatment of fluoborates, carbon adsorption, and starch xanthate, are discussed. Results of industrial and EPA pilot tests are presented. Pollutants being controlled are primarily: cyanide, chromium, zinc, nickel, and copper. An ion exchange process to recover aluminum from phosphoric acid waste generated by bright finishing of aluminum parts, is described, as is the Reciprocating Flow Ion Exchange method. An electrolytic technique based on semiconductive beds of carbon particles for the reduction of hexavalent chromium and the oxidation of cyanides, was evaluated. Advanced chemical techniques include the Kastone process with zinc recovery, and the Sulfex process. (See also W79-06328) (Small-FIRL)
W79-06327

ADVANCED TREATMENT APPROACHES FOR METAL FINISHING WASTEWATERS PART II,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
H. S. Skovronek, and M. K. Stinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 148, Price codes: A02 in paper copy, A01 in microfiche. Report EPA 600/J-77-0566 1977. 5 p, 8 fig, 1 tab, 46 ref.

Descriptors: *Industrial wastes, *Water pollution sources, *Reverse osmosis, *Electrodialysis, *Membrane processes, Separation techniques, Solvent extractions, Freezing, Costs, *Performance, Sludge treatment.

New technologies for the control, recycle, and destruction of water pollutants generated in the electroplating and related industries, are described. Reverse osmosis, electrodialysis, newer membrane techniques, solvent-based systems, and freezing are considered. The advantages of reverse osmosis techniques include low capital cost, low space requirements, and low labor costs. Results of EPA tests with three new membranes were encouraging for PA-300, PBIL, and NS-100. A successful application of electrodialysis to nickel recovery is related as is unsuccessful attempt to recover cyanide. Donnan dialysis is being developed and shows promise in chromate and copper treatment. The ZDS system is described which utilizes a combination of countercurrent rinsing and displacement by immiscible fluids to separate dissolved chemicals from rinse water, is described. Freezing is discussed as a possible future treatment method. Control options for sludge are considered briefly. (See also W79-06327) (Small-FIRL)
W79-06328

EVALUATION OF A VAPOR COMPRESSION DISTILLATION UNIT FOR LAUNDRY WASTEWATER REUSE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. McCarthy, and R. H. Chyrek.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 765, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7711. 1977. 44 p, 10 fig, 10 tab, 6 ref.

Descriptors: *Recycling, Waste water treatment, *Distillation, Domestic water, *Laundering, Testing, *Performance, *Mechanical equipment, Water quality, Energy, Maintenance.

A nominal 6 gph vapor compression distillation unit (VCDU) built by Chemtric, Inc. of Rosemont, IL, was evaluated using laundry waste water. Product water quality and energy use rates were determined, and operation and maintenance were monitored for a 16 wk period. Product water quality from the laundry waste water feed when compared with tap water was lower in turbidity, total solids, and conductivity, but higher in total organic carbon and chemical oxygen demand. When all heat was supplied solely by vapor compression, there was minimum energy use. Use of the storage tank heater caused maximum energy use. In actual operation, use of the storage tank heater averaged 655 watt/hr/gal of water produced. Energy use rates were generally high because of intermittent unit operation, lack of adequate operator controls, and severe maintenance problems. Energy use requirements were elevated by poor heat transfer conditions caused by varying water levels and convective currents in the sump and storage tanks. Operation of the VCDU was stopped when foam from the concentrated waste water began to carry-over into the product water in spite of a foam entrainment control medium. When foam carry-over became consistent, product water quality deteriorated rapidly. (Small-FIRL)
W79-06329

CONCEPTUAL DESIGN OF A PILOT WASTEWATER IRRADIATION FACILITY,
Army Facilities Engineering Support Agency, Fort Belvoir, VA.
C. Everline.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 788, Price codes: A07 in paper copy, A01 in microfiche. Final Report, 1977. 226 p, 36 fig, 21 tab, 1 append.

Descriptors: *Irradiation, Radiation, *Waste water treatment, *Sewage treatment, *Pilot plants, *Design, Microorganisms, Sampling.

The design of a pilot waste water irradiation treatment plant is presented and discussed. To determine the effects of gamma irradiation on all phases of sewage treatment, the facility should be connected to an operating waste plant in such a manner that influent sewage can be sampled as well as primary, secondary, and tertiary effluent. Initial waste water composition will be analyzed for microbe concentration, surfactants, phenols, dissolved oxygen, and free chlorine. In the mixing and holding tank, the sewage could be chemically treated before irradiation. Irradiation time will be limited by a flow meter, and a recycle loop can be utilized. All effluent will be passed through a radiation monitor before being discharged. Plant layout and radiological protection are described, as are peripheral equipment design and source selection. Nuclear design of the irradiator is also described. (Small-FIRL)
W79-06333

TOXICOLOGICAL INVESTIGATIONS O PILOT TREATMENT PLANT WASTEWATER AT HOLSTON ARMY AMMUNITION PLANT
Battelle Columbus Labs. Columbus, OH.
J. M. Stilwell, M. A. Eischen, W. L. Margard, M. C. Matthews, and T. B. Stanford.
Available from the National Technical Informatio Service, Springfield, VA 22161 as AD-A042 60 Price codes: A04 in paper copy, A01 in microfich Final Report July 27, 1977. 46 p, 11 fig, 11 tab, 2 ref, 2 append.

Descriptors: *Chemical wastes, *Trickling filter *Activated sludge, *Toxicity, *Biological trea ment, Lethal limit, Industrial wastes, Chemic oxygen demand, Nutrients, Waste water trea ments, Pilot plants, Bioassay, Chemical analysi

Several waste waters from effluent streams at th Holston Army Ammunition Plant were treated i an activated sludge chamber or in a trickling filte followed by activated sludge treatment; treate effluent was subjected to 96-hour acute LC50 bio assay tests with fathead minnows to determin toxicity. The pilot plant tests were conducted o two effluent streams mixed in a ratio of 1:9 b volume; one effluent sample was composed o waste water from 10 effluent sources while th second was a mixture of four samples plus synthet ic wastes added to increase the COD to 400 mg liter. The wastes were either treated by the activat ed sludge method or passed through a tricklin filter prior to activated sludge treatment. Bioassa tests were conducted for each individual wast water, the mixture of both effluents, effluent fro the activated sludge treatment, and effluent fro the combined treatment. The toxic effects of th waste waters were correlated with high levels o HMX, COD, BOD, pH, NH3, TKN, PO4, NO and total solids. LC50 values of the first wast stream indicated it was the most toxic at a value o 1%. The second effluent had LC50 values rangin 6.2-43.8% while the combined wastes has LC5 values from between 1.43-14.0%. The treate waste water exhibited significantly lower toxicity with LC50 values of >70%. The levels of RDX i the effluents were not considered toxic in the bio assay tests. Biological treatment of ammunitio waste waters was considered suitable for reducin toxicity. (Lisk-Firl)
W79-06334

THE ROLE OF SEWAGE LAGOONS AT CORPS OF ENGINEERS RECREATION AREAS,
Army Engineering Waterways Experiment Sta tion, Vicksburg, MS. Environmental Effects Lab T. D. Hand, and R. R. Williams.
Available from the National Technical Informatio Service, Springfield, VA 22161 as AD-A047 833 Price codes: A04 in paper copy, A01 in microfiche Final Report 1977. 55 p, 6 tab, 66 ref, append

Descriptors: *Sewage lagoons, *Performance *Seasonal, Design, Recreation, Aerated lagoons Sewage treatment, Algal control.

The role of Corps of Engineers recreation are sewage lagoons was assessed by reviewing curren technology and current Corps needs. A literatur review was conducted to determine design, oper ation, and upgrading methods which could be ap plicable to the special loading problems and othe characteristics of recreation area sewage lagoons Also, a survey established the geographic distribu tion and the design and performance successes and failures of the 200 lagoons. Facultative lagoon were well suited to seasonal recreation areas. Me chanical aeration can be used to upgrade over loaded lagoons. Anaerobic lagoons were not usefu for this application. Where annual evaporation ex ceeds precipitation, total retension lagoons were successful. In northern areas, controlled discharge was effective, but this needs to be developed in warm, humid areas. Phase isolation seems to be a promising development, but it has not been evalu ated sufficiently. Effective methods for removing algal solids are reviewed. Most Corps lagoons are operating at hydraulic and organic loads far below design levels. (Small-Firl)
W79-06335

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8A.
W79-06337

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
D. C. Lindsten, and P. R. DesRoches.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 203, Price codes: 04 in paper copy, A01 in microfiche. Report June 1977. 66 p, 16 fig, 31 tab, 1 append.

Descriptors: *Chemical wastes, *Radioactive wastes, *Reverse osmosis, *Membranes, *Potable water, Sea water, Brackish water, Water pollution, Cesium, Iodine, Strontium, Chemical warfare, Water pollution sources, Waste water treatment, Water treatment, Separation techniques.

Performance tests were conducted on a reverse osmosis water purification unit with two types of membranes for treating polluted fresh water, sea water, brackish water, and water contaminated with chemical, biological, and radiological agents. The model unit was a 600 gal/hr Reverse Osmosis Water Purification Unit for producing potable water. The membranes compared were a dry, modified, brackish-water type cellulose acetate membrane and a sea water type polyamide membrane. The chemical agents were GB, VX, and BZ while the radiological agents were iodine-131, strontium-85, and cesium-134. The polyamide membrane was found to be superior to the cellulose acetate membrane, although both were effective in the removal of turbidity, conductivity, color, alkalinity, hardness, and dissolved solids from raw water. The polyamide membrane removed more than 99% of the chemical contaminants and removed 95.5% of the iodine-131, 99.7% of the strontium-85, and 98.8% of the cesium-134, on the average. The polyamide membrane was not, however, able to consistently reduce the levels of the chemical and radiological contaminants in the water to within the maximum permissible concentration (MPC). A post, activated carbon column to treat the permeate from the reverse osmosis unit and further research of the treatment process were recommended. (Lisk-FIRL)
W79-06340

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 5E.
W79-06341

FINAL EIS GREENSBORO-GUILFORD COUNTY, N.C. 201 WASTEWATER TREATMENT SYSTEM PROJECT NO. C37037601.
Environmental Protection Agency, Atlanta, GA. Region IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 694, Price codes: A19 in paper copy, A01 in microfiche. Report EPA 904/0-77-037. 1977. 445 p, 8 fig, 7 tab, append.

Descriptors: Waste wate treatment, Sewage treatment, *North Carolina, *Streams, *Environmental effects, Terrestrial habitats, *Tertiary treatment, Sewers, Air pollution effects, Odor, *Environmental Impact Statement.

This environmental impact statement was prepared in response to the awarding of a grant to the city of Greenboro, NC, for the purpose of developing a waste water treatment system to service about 36 mgd of waste water for the Greensboro-Guilford County area. The proposed action consisted of upgrading an existing plant to teriary treatment at 6 mgd, abandoning one plant, and building a new 0 mgd plant with tertiary treatment. Direct adverse environmental impacts were minor. They included sewer construction and plant construction causing short-term stream siltation and increased airborne particulate, destruction of some natural vegetation, temporary noise levels that exceed acceptable thresholds, and reduced flow in a segment of Buffalo Creek. Potential secondary adverse impacts include possible flooding and erosion, continued terrestrial habitat attrition, and increased air pollution due to population increases. Beneficial impacts include meeting the effluent limits for the creeks, elimination of an odor source, and allowance for planning orderly urban growth while minimizing urban sprawl. Seven alternatives are presented. (Small-FIRL)
W79-06345

DRAFT ENVIRONMENTAL IMPACT STATEMENT. HENDERSON, NORTH CAROLINA, 201 WASTEWATER TREATMENT SYSTEM.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 095, Price codes: A14 in paper copy, A01 in microfiche. 1976. 181 p, 48 fig, 41 tab, 70 ref.

Descriptors: *Waste water treatment, *Municipal wastes, Odors, Phosphorus, *Environmental effects, Water quality, Bodies of water, North Carolina, *Water pollution sources, *Environmental Impact Statement.

Three alternative waste water treatment systems to service the Greater Henderson area were developed. The major environmental impacts associated with the water quality downstream of the waste water treatment plant discharges are described. Using Alternative A, the Red Bud Creek treatment plant would be abandoned, the existing Nutbush Creek plant would be upgraded to a capacity of 1.58 mgd with odor controls and phosphorus removal, and a 2.12 mgd plant would be constructed on Sandy Creek. Alternative A would cause moderate adverse impacts on Sandy Creek, a substantial improvement in Nutbush Creek water quality, and a moderate increase in Kerr Reservoir water quality. Using Alternative B, the Red Bud Creek plant would be abandoned and a new 3.7 mgd plant would be constructed on Sandy Creek. This alternative would cause major improvement in Nutbush Creek water quality and a moderate adverse impact on Sandy Creek. Using Alternative C, The Red Bud Creek plant would be abandoned and the Nutbush Creek plant would be upgraded or expanded to 3.7 mgd with phosphorus removal and odor controls. This alternative would cause a substantial increase in the water quality of Nutbush Creek and Kerr Reservoir. (Small-FIRL)
W79-06346

MANAGEMENT OF METAL-FINISHING SLUDGE,
E. P. Crumpler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 946, Price codes: A04 in paper copy, A01 in microfiche. Report EPA/530/SW-561 1977. 62 p, 8 fig, 2 tab, 31 ref.

Descriptors: *Sludge treatment, *Sludge disposal, *Recycling, Chemical precipitation, Metallurgy, *Industrial wastes, Reverse osmosis, Ion exchange, Solvent extractions, Electrodialysis.

The state-of-the-art technology for the management of metal-finishing sludge is discussed. Disposal techniques, recycle and waste reduction technology are reviewed. The major advantages and disadvantages of each technique are presented, along with current EPA research and demonstration efforts. Environmentally adequate disposal technology includes encapsulation, heat treatment, chemical lining of disposal cells, and chemical fixation. Water treatment processes which produce nonhydroxide sludge include sulfide precipitation and starch xanthate precipitation. Internal recycle of rinse water dragout includes evaporative recovery, reverse osmosis, ion exchange, electrodialysis, freeze separation, solvent rinsing, and ion floatation. External recovery of segregated metals from sludges and solutions includes integrated treatment, Kastone treatment process, single metal sludge recovery, and spent bath recovery. Recovery of metals from mixed hydroxide sludges includes solvent extraction and electrochemical roasting. (Small-FIRL)
W79-06347

IN SITU TREATMENT OF HAZARDOUS MATERIAL SPILLS IN FLOWING STREAMS,
Battelle-Northwest, Richland, WA.
G. W. Dawson, B. W. Mercer, and R. C. Parkhurst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 455, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-164. October 1977. 49 p, 16 fig, 8 tab, 9 ref.

Descriptors: *Activated carbon, *Chemical wastes, *Adsorption, *Running waters, *Application methods, Granules, Porous media, Treatment, Waste water treatment, Water pollution, Disasters, Water treatment, Separation techniques.

Buoyant activated carbon and porous fiber bags packed with granular activated carbon were compared for treating, in situ, chemical wastes from spills in flowing streams. Tests were conducted in a renovated irrigation ditch carrying water at flow rates between 3.98-4.45 cu ft/sec spiked with 4 lb methylisobutyl ketone (hexone), 1 lb of methanol, and 0.1 lb of rhodamine dye to simulate hazardous chemical wastes. Buoyant activated carbon was added by sub-surface and surface introduction to the waste flow and subsequently recovered by conventional skimming techniques. The non-buoyant packaged carbon bags were attached to floats and allowed to flow with the spill plume for a distance before manual removal. Flow rates of the waste water were varied in the irrigation channel which had a quiescent section. Buoyant carbon was superior to the carbon-filled bags, achieving 50% waste removal at carbon to contaminant ratios of 10:1; carbon recovery exceeded 90%. Containment removal by the porous bags was directly related to turbulence and current structure in the receiving water body, achieving 20% removal at a flow rate of 15 cu ft/sec. Up to 25% of the bags were lost due to snagging and shore capture. The bags were considered easier to handle and steam stripping was suitable for regenerating the hexone. An air deliverable slurry injection system was recommended for introduction of buoyant carbon and further investigations of the treatment methods were recommended. (Lisk-FIRL)
W79-06348

INDUSTRIAL WASTEWATER RECIRCULATION SYSTEM: PRELIMINARY ENGINEERING,
Owens-Corning Fiberglas Corp., Toledo, OH.
A. W. Loven, and J. L. Pintenich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 990, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-043, 1977. 150 p, 61 fig, 33 tab.

Descriptors: *Industrial wastes, *Recycling, *Waste water treatment, Filtration, *Performance, Activated carbon, Disinfection, Reverse osmosis, *Pilot plants.

Various technologies for a closed-loop, industrial waste water system were tested on a pilot plant scale at a fibrous glass plant. Sand filtration, activated carbon adsorption, and disinfection methods were tested and found to yield water suitable for reuse. If removal of inorganic dissolved solids is required, it can be accomplished through treatment by reverse osmosis or lime-soda softening/anion exchange. Complete physical and chemical treatment of fibrous glass plant wastes is not feasible due to extreme residual concentrations of nonadsorbable organic compounds. Construction of a full-scale plant is planned. The projected design loadings for advanced waste water treatment processes are: Flow = 285 gpm; TSS loading = 31 lb/day; and TOC loading = 116 lb/day. (Small-FIRL)

W79-06349

FEASIBILITY STUDY ON IN-SEWER TREATMENT METHODS,
Pomeroy, Johnston and Bailey, Pasadena, CA.
R. D. Pomeroy, and R. J. Lofy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 445, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-192 1977. 106 p, 16 fig, 10 tab, 22 ref, 2 append.

Descriptors: *Waste water treatment, *Sewers, Biochemical oxygen demand, *Oxygen, Activated sludge, Flocculation, Flow, Slopes, Sewage treatment.

Biological, chemical, and physical methods of in-sewer waste water treatment are discussed. Promise is seen in biological oxidation which leads to a partial reduction of BOD. An appreciable reduction of BOD occurs normally in sewers. Equations are developed which can estimate this oxidation. A high degree of treatment requires an adequate oxygen supply, and oxidizing culture, and time. The culture could be suspended in the form of activated sludge or attached to solid surfaces. Possible methods for supplying oxygen are discussed. The prospects for a useful degree of in-sewer treatment are good for force mains. Under certain limited conditions, a sewer can function as an efficient flocculation device in conjunction with chemical treatment. Slope-flow relationships in most sewers produce velocity gradients suitable for flocculation of aluminum hydroxide and iron hydroxide. (Small-FIRL)
W79-06350

APPRAISAL OF POWDERED ACTIVATED CARBON PROCESSES FOR MUNICIPAL WASTEWATER TREATMENT,
Battelle-Northwest, Richland, WA.
A. J. Shuckrow, and G. J. Culp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 933, Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-77-156, 1977. 340 p, 27 fig, 137 tab, 44 ref, 1 append.

Descriptors: *Activated carbon, *Sewage treatment, Activated sludge, Nitrification, *Evaluation, *Costs, Performance, *Granules, Municipal wastes.

All work with powdered activated carbon (PAC) and PAC regeneration was reviewed, and representative processes were compared with activated sludge, activated sludge with nitrification, and granular activated carbon. No one PAC approach was superior from a performance point of view. Biophysical processes were attractive because they can be incorporated into existing biological plants. Capital and operating costs were compared for plants with throughput rates of 1, 5, 10, 25, and 50 mgd. Independent physical-chemical PAC systems were not economically competitive with other modes of treatment. PAC can offer advantages for specific cases where highly variant flows are experienced such as plant receiving flows of a seasonal nature or areas with combined storm sewer systems. Possible improvements which could make PAC competitive were investigated. Lower carbon doses and/or inexpensive throwaway carbon are necessary to make the system competitive with the other systems evaluated. (Small-FIRL)
W79-06352

CONTROL OF REFINERY VACUUM PRODUCING SYSTEMS, WASTEWATER SEPARATORS AND PROCESS UNIT TURNAROUNDS,
Environmental Protection Agency, Research Triangle Park, NC. Office of Air Quality Planning and Standards.
K. C. Hustvedt, and R. A. Quaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 662, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-450/2-77-025, October 1977. 40 p, 4 fig, 5 tab, 40 ref.

Descriptors: *Air pollution, *Oil industry, *Organic compounds, *Oil wastes, *Separation techniques, Oily water, Maintenance, Economics, Gases, Vapor pressure, Volatility.

The technology, impacts, regulations, and economics of controlling volatile organic compound (VOC) emissions from vacuum producing systems, waste water separators, and process unit turnabouts in petroleum refineries are discussed. VOC emissions from vacuum producing systems may be controlled by passing non-condensable vapors to a fire-box, incinerator, or to a compressing system. Waste water separator emissions may be minimized by covering forebays and separator sections; types of covers suitable for these areas are described. Process unit turnabouts, such as shutdowns, repairs, inspections, and start ups, may incorporate systems where vapors are added to the fuel gas system, flared, or vented to the atmosphere; VOC emissions will be minimized if vapors are combusted with fuel gas or flared until the pressure in the vessel is close to atmospheric pressure. An economic analysis of control systems considers all the technical parameters used in developing control costs. The impacts of these emission control technologies on energy and the environmental are discussed briefly. Regulatory aspects reviewed include the identification of plants to which regulations would apply, the selection of an appropriate format, and recommendations for compliance and monitoring techniques. (Lisk-FIRL)
W79-06355

AUTOMATIC EXCHANGE RESIN PILOT PLANT FOR REMOVAL OF TEXTILE DYE WASTES,
Bennett Coll., Greensboro, NC.
A. Maggiolo, and J. H. Sayles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 362, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-136. 1977. 54 p, 18 fig, 5 tab, 7 ref, 1 append.

Descriptors: *Resins, *Adsorption, Waste water treatment, *Dyes, *Industrial wastes, *Cost comparisons, Automation, Capital costs, Recycling, Solubility, Laboratory tests.

Adsorption resins were used to remove colored dyes from textile dyeing waste waters using an automated bench-scale pilot unit. This method could make possible the reuse of treated waste waters in subsequent dyeing operations at competitive costs. At a waste water treatment rate of 20,000 gpd by resin adsorption, the amortized operating cost was estimated at $3.47/1000 gal. Capital investment was estimated at $86,000. Operating costs for alternative processes, ozonation, carbon treatment, and hyperfiltration (reverse osmosis) are $1.90, $1.00, and $2.00/1000 gal, respectively, on a one million gpd rate of operation. These costs would equal or exceed the estimated costs for the resin adsorption process when scaled down to the typical 20,000 gpd dispersed dye hosiery plant basis. Adsorption resins have the advantage of removing insoluble dispersed dyes from waste water. The three alternative processes effectively remove soluble dyes, but not much is known about their effectiveness in removing insoluble dyes. Insoluble dyes are non-responsive to biological waste treatment. (Small-FIRL)
W79-06356

BENEFICIAL DISPOSAL OF WATER PURIFICATION PLANT SLUDGES IN WASTE-WATER TREATMENT,
North Marin County Water District, Novato, CA.
J. O. Nelson, C. A. Joseph, and R. L. Culp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 230, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-78-089, 1978. 33 p, 2 fig, 6 tab.

Descriptors: *Water purification, Sludge treatment, *Activated sludge, Waste water treatment, Municipal wastes, Sewers, Chemical oxygen demand, Biological oxygen demand, Phosphor
*Sludge digestion, *Solid wastes, Settling veloci
Costs.

The effects and costs of discharging alum slud
from a municipal water clarification plant into
sanitary sewer system and activated sludge sewa
treatment plant, were investigated. The addition
the alum sludge caused the following changes. T
efficiency of primary settling decreased abo
10%, while the efficiencies of COD and BO
removals were unchanged. Phosphorus remov
was improved by 12%, and scum removal a
sludge settling improved. The capacity of cent
fuges for sludge dewatering was increased 12
50%. Digester gas production increased partial
because of improved mixing of digester conten
A slight improvement was noted in final efflue
turbidities. There were no observed adverse effe
on overall plant performance. (Small-FIRL)
W79-06361

ODOR ASSESSMENT FOR SEWAGE SLUDG SAMPLES 300A01002,
Battelle Pacific Northwest Labs., Richland, W
D. B. Cash, and P. M. Molton.
Available from the National Technical Informatio
Service, Springfield, VA 22161 as BNWL-217
Price codes: A05 in paper copy, A01 in microfich
Report BNWL-2177, December 1976. 90 p, 44 fi
13 tab, 2 append.

Descriptors: *Odor, *Sewage sludge, *Slud
treatment, *Irradiation, *Sludge digestion, G
chromatography, Heat treatment, Analytical tec
niques, Pollutant identification, Sewage treatme

Dilution-to-threshold tests were performed
assess the odor levels in digested and undigeste
sewage sludge treated with a combination of irr
diation and heat. Changes in the odor of th
sludges were evaluated over a seven day perio
Treated and untreated undigested sewage slud
and treated and untreated digested sludge demo
strated significant odor transformations over th
seven day testing period. Treated undigeste
sludge had a stronger odor than untreated und
gested sludge. All samples demonstrated a patte
in which odor increased to a maximum threshol
odor number, followed by a slight decrease
odor; the samples, however, did not reach th
maximum threshold odor number on the same da
Treated digested sewage sludge had a strong
odor than untreated digested sludge and attained
maximum threshold odor number of 683,000. U
treated digested sludge had a maximum odor lev
of 190,000. Components of sewage volatiles ident
fied by gas chromatography demonstrated a tim
dependent variation, attaining distinct maximum
after two to four days of exposure to air. Th
individual peaks obtained for sewage volatiles b
gas chromatography were considered potential i
dicators for measuring odor strength of undigeste
sewage sludge. The influence of two peaks on
third peak that was considered an odoriferou
component was not determined. (Lisk-FIRL)
W79-06364

BREAKING EMULSIONS IN NAVY BILG COLLECTION AND TREATMENT SYSTEMS
Naval Research Lab., Washington, DC.
R. C. Little, and R. L. Patterson.
Available from the National Technical Informatio
Service, Springfield, VA 22161 as AD-A033 64
Price codes: A04 in paper copy, A01 in microfiche
Memorandum Report 3424, 1976. 51 p, 9 tab, 2
ref, 1 append.

Descriptors: *Ships, *Waste water treatment, Oil
water, *Seepage, *Emulsions, Pilot plants, *Ca
tions, Water pollution sources, Oil pollution.

Laboratory and field tests were conducted of
new bilge waste water collection and treatmen
system which serves as the collector, transported
and gravity separator for ship's bilge waste. A
class of cationic demulsifiers was identified whic
met performance requirements. The waste oil ra
was an acceptable vehicle for oil-in-water emulsio
breaking operations when mixing methods for th

demulsifier are adequate. A pilot plant study of demulsifier effectiveness for oil-in-water emulsions in waste oil rafts is recommended to gain the widest possible field experience. The use of cationic agents in shore-based only waste treatment plants should also be considered. (Small-FIRL)
W79-06368

EVALUATION OF OZONATION AND CHLORINATION FOR DISINFECTION OF BLACKWATER,
Abcor, Inc., Wilmington, MA. Walden Div.
K. J. McNulty, and R. L. Goldsmith.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 734, Price codes: A05 in paper copy, A01 in microfiche. Final Report December 1976. 89 p, 43 fig, 6 tab, 13 ref.

Descriptors: *Chlorination, *Ozone, *Disinfection, *Ships, *Waste water, Hydrogen ion concentration, Temperature, Coliforms, Operating costs, Capital costs.

Disinfection tests on marine vessel blackwater compared ozonation and chlorination at various concentrations, temperatures, and pH's for reducing fecal coliform levels to 200 colonies/100 ml. Experiments focused on ozone or chlorine dosages required at temperatures of 15C and 30C and pH ranging from 5-9. Ozonation was unaffected by temperature and pH while the required chlorine dosage appeared to increase with temperature and pH (at 30C). The variation in blackwater samples was cited as a possible reason for the increase in chlorine requirements. Results of the disinfection study indicated that an ozone dosage of 750 mg/liter was required to attain the desired fecal coliform level while a chlorine concentration of 240 mg/liter was necessary. An economic analysis of the two treatment methods determined that operating and capital costs for the ozonation system were three times greater than the costs for a chlorination system. Ozonation, however, was considered to have the advantages of better viricide action and no production of chlorinated hydrocarbons. (Lisk-FIRL)
W79-06370

ENZYME TECHNOLOGY FOR SHIPBOARD WASTE MANAGEMENT,
David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
L. R. Harris, and A. E. Lardis.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 730, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 76-0117, 1976. 28 p, 5 tab, 38 ref.

Descriptors: *Enzymes, *Ships, Oil pollution, *Oily water, *Waste water treatment, Water pollution sources, Odor cleaning.

Current enzyme technology and applications were reviewed, and areas were identified where enzymes may provide solutions to shipboard waste management problems. Enzyme characteristics were discussed including enzyme kinetics, reactors, and immobilization, and current applications are reviewed. Waste water treatment methods being considered by the Navy include utilization of a packed bed immobilized enzyme system, an enzyme cellulase process, enhancement of UF performance using enzymes, and detoxifying organotin compounds. Enzymes systems are also being considered for odor control, cleaning operations, oil pollution control and analytical monitoring. Research and development recommendations are made including development of a shipboard waste water treatment system based on immobilized enzyme technology, and determination of the feasibility of adding enzyme/bacterial products for controlling oil discharges from ballast tanks. (Small-FIRL)
W79-06372

HIGHLIGHTS OF RESEARCH ON OVERLAND FLOW FOR ADVANCED TREATMENT OF WASTEWATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. R. Lee, P. G. Hunt, R. E. Hoeppel, C. A. Carlson, and T. B. Delaney.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 864, Price codes: A03 in paper copy, A01 in microfiche. Technical Report Y-76-6, 1976. 24 p, 9 fig, 4 tab, 17 ref.

Descriptors: Tertiary treatment, *Municipal wastes, Waste water treatment, *Overland flow, Slopes, *Heavy metals, *Nitrogen, *Phosphorus, Performance.

Greenhouse grass-soil models were used to study the overland flow treatment of municipal waste water. The response of overland flow treatment of nitrogen, phosphorus, and heavy metals to various operating conditions was determined. Overland flow was an efficient nitrogen removal method. Up to 99% nitrogen removal was obtained at a 2% slope with an application period of either 6 or 18 hr. Phosphorus removal was about 80 to 84% when 0.5 inch/acre of waste water was applied to a 2% slope in either 6 or 18 hr. Waste water flowing over the soil does not have extensive contact with iron and aluminum compounds in the soil that fix massive amounts of phosphorus. Heavy metal removal was greater than 90% when 0.5/inch/acre of waste water was applied in 6 hr on a 2% slope. Overland flow systems require extensive construction, a suitable cover crop, waste water storage during cold weather, and a flow rate no greater than 0.5 inch/acre/day. (Small-FIRL)
W79-06373

LABORATORY RESULTS OF LAUNDRY WASTEWATER TREATMENT,
Army Facilities Engineering Support Agency, Fort Belvoir, VA. Research and Technology Div.
M. Botros, and W. C. Best.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A039 603, Price codes: A04 in paper copy, A01 in microfiche. Report FESA-RT-2017, 1976. 49 p, 13 fig, 5 tab, 3 ref.

Descriptors: Laundering, *Domestic wastes, Waste water treatment, *Recycling, *Coagulation, *Flocculation, Sulfates, *Filtration, Filters, Cost analysis.

A laboratory investigation was conducted of the chemical treatment of laundry waste water using different coagulation and flocculation compounds. When ferric chloride was used, sodium hydroxide and WT-2700 (1 flocculation aid) were used which increased costs and required a complicated treatment design. When aluminum sulfate and lime were used, water hardness increased. The use of Al2(SO4)3 alone gave good results, and the use of Al3(SO4)3 with polyelectrolyte WT-2700 gave excellent results. Good flocculation was obtained in a pH range of 5.5-6.5 and a temperature range of 25-35C with flow turbidity. Filtration was also discussed including the design of the ideal sand filter, the use of polymers as a filtration aid, and types of filter structures. The recycling of laundry wastewater at army installations would not be cost effective. (Small-FIRL)
W79-06375

COUNTERCURRENT RINSING ON A HIGH-SPEED HALOGEN TINPLATING LINE,
National Steel Corp., Weirton, WV. Weirton Steel Div.
D. A. Pengidore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 590, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-191, 1977. 94 p, 19 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Waste water treatment, *Industrial wastes, *Recycling, *Metallurgy, Chemicals, Steel, Metals.

The first use of countercurrent rinsing on a high speed plating line was investigated. The operating performance of the multistage rinse system was studied to determine whether or not the basic principles of countercurrent rinsing would hold. Also, the best method for recovering the chemicals in the concentrated stream from this rinse system were determined. Also described are efforts to recycle the concentrated rinse back into the main plating system. The problems encountered in the direct recycle may be solved by a new technique in removing sodium ions from the rinse stream or the main bath. Plans are underway to recover the tin values from the dragout recovery system by sending the rinse solution to the Detinning Plant. Full recovery of fluorides and other constituents at the Detinning Plant is also under investigation. (Small-FIRL)
W79-06381

REPORT ON THE PLANT EVALUATION AT OLD FAITHFUL WASTEWATER TREATMENT PLANT YELLOWSTONE NATIONAL PARK,
Environmental Protection Agency, Denver, CO. Region VIII.
O. K. Boe, and L. Malloy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 743, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-908/3-77-004, 1977. 10 p, 2 fig, 1 tab.

Descriptors: *Activated sludge, Aeration, Sewage, *Waste water treatment, *Nitrification, *Temperature, Settling basins, Nitrogen.

Observations and process control data obtained at the Old Faithful 0.51 mpg activated sludge waste water treatment plant were assessed by the EPA. The high temperature of the waste water was a critical factor which influenced all phases of operation. Warm sewage seemed to cause nitrification in the plant even though the facility was not designed to nitrify. Settleometer tests indicated the formation of extensive gas bubbles, probably nitrogen, which caused excessive floating of sludge in both the settlometer and the clarifier. Recommendations are made to reduce the degree of nitrification. A carefully controlled sludge wasting program should be established during start up, and the system may need to operate at less than design hydraulic detention times. The final clarifier should operate to minimize sludge detention times. One or more of the reaeration basins may be used as an N2 stripping basin. Process control tests and data analyses should be continued to further process control analyses. (Small-FIRL)
W79-06382

INVESTIGATION OF THE FEASIBILITY OF TERTIARY TREATMENT OF MUNICIPAL WASTEWATER STABILIZATION POND EFFLUENT USING RIVER WETLANDS IN MICHIGAN,
Williams and Works, Grand Rapids, MI.
J. C. Sutherland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 283, Price codes: A08 in paper copy, A01 in microfiche. Report, 1977. 164 p, 11 fig, 1 tab, 5 append.

Descriptors: Feasibility, *Wetlands, *Tertiary treatment, *Municipal wastes, Waste water treatment, Capital costs, *Michigan, Rivers, Energy, *Streams.

The engineering feasibility of using Michigan river wetlands for tertiary treatment of municipal waste water stabilization pond effluent was investigated as an alternative to upland spray irrigation and chemical tertiary treatment. An aerial reconnaissance was made of 75 Michigan Southern Peninsula rural municipalities with populations ranging from 360-2800 which utilized treatment ponds and had proximal streams. Thirty-five to 40% of these were estimated to have suitable wetlands. The method could yield capital cost savings totalling about $320,000 (1977 dollars) when used instead of upland irrigation, and about $150,000 when used instead of chemical treatment. Interaction with the Wisconsin Department of Natural Resources indicated interest in the wetlands treatment method for municipal application. The wetland method is esti-

mated to be the most cost effective when pond-wetland distance is less than four miles. Favorable capital cost advantages include anticipated low land cost and minimum of on-site hardware. Also, operational energy requirements would be low. (Small-FIRL)
W79-06383

THE FEASIBILITY OF ESTABLISHING OPERATIONAL WATER HYACINTH-BASED SYSTEMS AT THE TREATMENT FACILITIES OF EXISTING CITIES,
Caspan Corp., Houston, TX.
F. C. Urteaga.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-14947, Price codes: A04 in paper copy, A01 in microfiche. Final Report, 1977. 51 p, 12 tab, 4 ref.

Descriptors: *Municipal wastes, Groundwater, *Sewage lagoons, *Water hyacinth, Waste water treatment, Florida, Texas, Costs, Regulation, *Feasibility, Cities.

The feasibility of establishing operational water hyacinth treatment facilities at three South Florida and two South Texas communities of 20,000 residents or less, was investigated. Florida cities were not responsive and were generally unsuited to the suggested treatment system. The Florida Department of Environmental Regulation discourages the use of stabilization ponds and surface discharge. This is because of South Florida's very high groundwater table and the fact that treatment facilities had already reached advanced planning stages. South Texas communities, on the other hand, were excellent candidates for water hyacinth treatment because of current treatment systems, regulatory philosophy, stage of planning to meet permit requirements, and economic conditions. Stabilization ponds which could be converted, are common. Up-grading current facilities would, however, require financial assistance. (Small-FIRL)
W79-06384

VIRAL AND BACTERIAL AEROSOLS AT A WASTEWATER SPRAY IRRIGATION SITE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
H. T. Bausum, S. A. Schaub, and K. F. Kenyon.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-054 436, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7804, 1976. 37 p, 2 fig, 14 tab, 14 ref.

Descriptors: *On-site tests, *Spraying, *Aerosols, Waste water, Microorganisms, *Aerobic bacteria, Fluorescent dye, *Tracers, Model studies, Viruses.

The second phase of a field study to measure microbiological aerosol dissemination by the spray irrigation mode of land waste water application was conducted at Ft. Huachuca, AZ. Bacterial and virus aerosols were sampled after spraying chlorinated and unchlorinated secondarily treated waste waters during periods of high and low sunlight intensity. Predictions were attempted of long distance migration and aerosol dispersal of total aerobic bacteria and enteric virus using seeded coliphage f2 as a model. In some runs, the waste water was seeded with sodium fluorescein dye to estimate physical aerosol decay. In chlorinated effluent, aerobic bacteria averaged 240,000 cfu/mg (standard plate count). One hundred and fifty m downwind of the sprayer, bacterial aerosol levels were as high as 9900/cu m at 46 m. Downwind levels were inhanced by darkness or low solar radiation. Chlorination at about 6 mg/liter reduced waste water effluent bacterial levels 3300-fold, and reduced bacterial aerosols to near background levels at all distances. Fluorescein dye aerosol levels remained somewhat higher in relation to source strength than bacterial levels, providing an indication of the extent of early bacterial die-off. Source strength and meteorological date were used in conjunction with a dispersion model to generate mathematical predictions of aerosol strength at each sampler location. Ratios of predicted aerosol strength to observed strength ranged from 308 to 1661. (Small-FIRL)
W79-06385

EVALUATION OF MEMBRANE SEPARATION PROCESSES, CARBON ADSORPTION, AND OZONATION FOR TREATMENT OF MUST HOSPITAL WASTES,
Abcor, Inc., Wilmington, MA. Walden Div.
A. Z. Gollan, K. J. McNulty, R. L. Goldsmith, M. H. Kleper, and D. C. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 057, Price codes: A20 in paper copy, A01 in microfiche. Final Report, 1976. 437 p, 80 fig, 53 tab, 33 ref, 11 append.

Descriptors: Waste water treatment, *Reverse osmosis, *Adsorption, *Ozone, Membranes, *Filtration, *Hospitals, Organic matter.

The development of a compact 4000 gpd waste system to process non-sanitary wastes at a MUST army field hospital was investigated. Processes evaluated included waste equalization, ultrafiltration (UF), reverse osmosis (RO), and post treatment. A treatment sequence of waste equalization, UF, RO, O3, ion exchange, and Cl2 produced an effluent suitable for reuse. This treatment sequence also produced satisfactory discharge effluent for laundry composite wastes but not for laboratory wastes. This treatment sequence also produced potable water from brackish surface waters. A process design was developed for a system capable of operating in either the reuse mode or the waste-treatment/water-treatment mode. The system satisfies all quality specifications except for laboratory wastes. When operating on laboratory wastes, the system will have a reduced output capacity because of the organic content of the laboratory waste RO permeate exceeds the treatment capabilities of the ozonation system. (Small-FIRL)
W79-06386

5E. Ultimate Disposal Of Wastes

CLEANING CONTAMINATED GROUND WATER.
For primary bibliographic entry see Field 5D.
W79-06003

ECONOMIC ASSESSMENT OF FGD SLUDGE DISPOSAL ALTERNATIVES,
Tennessee Valley Authority, Muscle Shoals, AL.
J. W. Barrier, H. L. Faucett, and L. J. Henson.
Journal of the Environmental Division, American Society of Civil Engineers, Vol 104, No 5, p 951-966, October 1978. 13 tab, 25 ref.

Descriptors: *Sludge disposal, *Flue gas desulfurization, *Electric powerplants, *Waste disposal, *Alternative costs, Alternative planning, Slurries, Lime, Landfills, Ponds, Tennessee Valley Authority, Sulfur dioxide, Fly ash, Scrubbers, Economics, Costs, Coals, Chemfix process, IUCS process, Dravo process, Untreated ponding, Untreated sludge-fly blending, Gypsum.

Evaluation of six disposal processes for flue gas desulfurization (FGD) sludge indicated that in all case variations the gypsum option required the lowest capital investment and annual revenue requirement. The six alternatives were: (1) untreated ponding, (2) Dravo process, (3) IU Conversion Systems process, (4) Chemfix process, (5) untreated sludge-fly ash blending, and (6) gypsum. FGD systems are being installed in coal-fired steam-generator electric power plants to meet federal emission standards, to remove sulfur dioxide before flue gas is discharged in the atmosphere. Some 90% of systems employ scrubbing with lime or limestone slurry, resulting in reaction products requiring disposal. This report is based on option assessments made by the Tennessee Valley Authority. Conclusions: (1) gypsum requires a much smaller equipment investment than other options except untreated ponding, which requires a very expensive disposal pond; (2) altenatives involving pond disposal (untreated and Dravo) require th highest capital investments (all other processes i volve landfill disposal); (3) processes using chem cal treatment (Dravo, IUCS, and Chemfix) ha higher annual revenue requirements than the othe three; (4) both unit capital investment and un revenue requirements were slightly lower for larg plant sizes; and (5) capital and revenue require ments vary almost directly in proportion to quant fy of sludge. Other factors included remainin plant life, distance to disposal site, and type c transport. (Lynch-Wisconsin)
W79-06041

LAND MANAGEMENT OF SUBSURFACE-IN JECTED WASTEWATER LIQUID RESIDUALS
Colorado State Univ., Fort Collins. Dept. of Agri cultural and Chemical Engineering.
J. L. Smith, M. H. Lutkin, J. S. Latham, and A. de Haai.
Available from the National Technical Informatio Service, Springfield, VA 22161 as PB-280 162 Price codes: A03 in paper copy, A01 in microfiche Interim Report, 1977. 44 p, 6 fig, 3 tab, 8 ref, append.

Descriptors: *Pilot plant, *Ultimate disposal, *Irra diation, Kansas, *Disinfection, Sewage treatment *Waste water treatment, Costs, Injection wells Landfills.

Recommendations are made for the construction and operation of a Proof-of-Concept Experimen facility adjacent to the sewage treatment plant a Lawrence, Kansas. The objectives of the POCF were: to determine the acceptability of irradiation disinfection and subsurface injection as an alterna tive technology for current methods of stabiliza tion and handling waste water residuals; and, to define specific operational characteristics and eco nomics of irradiation disinfection and subsurface injection as a technology for the treatment o waste water residuals. The optimum configuration of treatment facilities utilizing irradiation disinfec tion and subsurface injection was to be determined Also, the environmental effects of subsurface injec tion of irradiation disinfected residuals, were to be investigated. Potential benefits of this research are reduced treatment costs, simplification of treat ment facilities, and preparation of a better and safer product for land application. (Small-FIRL)
W79-06331

FEASIBILITY STUDY OF VACUUM FILTRATION SYSTEMS FOR DEWATERING DREDGED MATERIAL,
Ryckman, Edgerley, Tomlinson, and Associates, Inc., St. Louis, MO.
B. W. Long, and D. J. Grana.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 773, Price codes: A09 in paper copy, A01 in microfiche. Technical Report, 1978. 169 p, 57 fig, 9 tab, 8 ref, 2 append.

Descriptors: *Filtration, *Dredging, *Dewatering, *Waste disposal, Particle size, Coagulation, Separation techniques, Lime, *Performance.

The feasibility of dewatering dredged material by vacuum filtration was investigated. Samples from six disposal areas were characterized: Penns Neck Spillway, Apalachicola Bay, Mobile Bay, Toledo Harbor, Craney Island, and Browns Lake. Particle size distributions, specific resistance to filtration, filter leaf studies, and bench-scale vacuum filtration studies were conducted. Seven chemical coagulants were investigated with each sample. Dredged material was effectively dewatered to 45 to 60% solids (depending on site) using lime dosages of 7 to 10% of the solids in the sample. Filter yields of up to 9.0 lb solids/sq ft/hr were observed. Generally, the quality of the filtrate was in the range of 500 to 1500 mg/liter suspended solids. Pilot plant studies are recommended to further evaluate the operating parameters of vacuum filtration. (Small-FIRL)
W79-06332

DEMILITARIZATION OF CS I. CHEMICAL DISPOSAL OF CS BY HYDROLYSIS,
Edgewood Arsenal, Aberdeen Proving Ground, MD.
M. E. Brooks, P. M. Davis, and S. Sass.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 469, Price codes: A02 in paper copy, A01 in microfiche. Technical Report, 1976. 19 p, 3 tab, 4 ref.

Descriptors: *Ultimate disposal, *Water pollution sources, *Hydrolysis, *Chemical warfare, Waste treatment.

Studies of the chemical disposal of CS (tear gas or orthochlorobenzamalonitrile) by conversion to a salable product, were performed. Alkaline hydrolysis of CS was selected as the simplest means of converting CS to a salable product, O-chlorobenzaldehyde. Initially isopropyl alcohol was used as a solvent, but when that failed to yield the desired salable end product, a slurry of 16.6 w/v% CS in 6.6% aqueous NaOH (2 moles of NaOH per mole of CS) was used. The O-chlorobenzaldahyde can be recovered from the water phase by extraction with benzene or methylene chloride. For plant scale demilitarization of CS, the following parameters are recommended: NaOH:CS ratio = 1.1:1, NaOH concentration = 6% or 12%, reaction temperature is 35 to 50C, reaction time = 10 min, product separation occurs as a second liquid phase, and product purification is by water wash at ambient temperatures. (Small-FIRL)
W79-06336

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
J. R. Bouzoun.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 300, Price codes: A03 in paper copy, A01 in microfiche. Special Report 77-33 October 1977. 31 p, 7 fig, 9 tab, 12 ref, 5 append.

Descriptors: *Spray irrigation, *Return flow, *Sewage treatment, *Flow rates, *Seasonal, Cold regions, Infiltration, Runoff, Monitoring, Test wells, Waste water treatment, Waste water disposal, Municipal wastes, Treatment facilities, Spraying.

Secondary effluent has been sprayed on a forested knoll in West Dover, Vermont, for two years as part of the land application waste water treatment operation. The rate of application was designed for a winter flow of 0.55 mgd; winter volumes are higher than other seasons due to an influx of winter vacationers. The spraying of effluent has been conducted at ambient temperatures down to 10F. Freezing problems in the spray nozzles and laterals have been corrected; all upward spraying nozzles are spaced 50 ft apart in summer and 25 ft apart in winter. Summer-Fall design flow rates average 0.30 mgd while Spring design flow rate average 0.11 mgd. Effluent samples, groundwater wells, diversion ditch flows, and nearby streams are being monitored to evaluate the treatment process. Further investigations are examining the possibility of producing snow from the secondary effluent to insulate the soil against freezing and thus insure infiltration of the water into the soil throughout the winter and reduce runoff during spring melt. (Lisk-FIRL)
W79-06341

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8D.
W79-06342

SOLID WASTE DISPOSAL BY LANDSPREADING TECHNIQUES,
Civil Engineering Lab. (Navy), Port Hueneme, CA.
E. R. Durlak.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-B017 149, Price codes: A04 in paper copy, A01 in microfiche. Technical Note N-1471, 1977. 74 p, 31 fig, 14 tab, 29 ref, 3 append.

Descriptors: *Solid waste, *Ultimate disposal, Sludge disposal, *Application methods, *Aerobic treatment, Vegetation, *Soil disposal fields, Soils, Waste treatment, Waste disposal.

The landspreading technique for solid waste disposal is described and discussed. Landspreading is the disposal of solid waste by mixing compostable materials into the topsoil so that the decomposition process remains aerobic. Landspreading advantages include minimum settling of the land, no undesirable odors or leachates, a potential for the support of vegetation, continued usefulness of the land, restoration in a minimum amount of time, and improvement in soil texture and water retention. Three types of construction rototillers and two types of soil were examined in a study of the homogenization of solid waste into the top soil to depths up to 20 inches. Rototillers adequately mixed 10 to 12 inches of soil with solid waste piled about 12 inches deep on the ground. The mixture in the test plots was both homogeneous and uniform to about 16 inches. Some plant growth resulted. (Small-FIRL)
W79-06343

PHOTOGRAPHIC WASTE UTILIZATION,
Horizons, Inc., Cleveland, OH.
S. S. Donovan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 065, Price codes: A02 in paper copy, A01 in microfiche. Technical Report AFAL-TR-76-162. 1976. 51 p, 14 fig, 23 tab, 26 ref.

Descriptors: *Waste water disposal, *Landfills, Sanitary engineering, *Photography, *Recycling, Ultimate disposal, Pollution abatement, *Chemical wastes.

The pollution hazards associated with the disposal of 10 tons/wk of photographic processing wastes were eliminated by incorporating photowaste into a ceramic foam, a ceramic castable, and to modify it to an untramarine pigment. The ceramic foam could be used as an insulating firebrick and the ceramic castable could be used as an insulating castable. Each green product contained 10 wt% of photowaste, and physical properties of the producta were identical or better than comparable commercial products. The foam cost about 23.6 cents/lb and the castable 25.5 cents/lb, to manufacture. Necessary capital equipment and a functional plant layout, are given. A portable unit for on-site foam fabrication under a wide range of climatic conditions is also described. All three approaches were technically feasible, but pigment fabrication was economically unfeasible. Tests were also conducted to render the waste harmless and suitable for a class three landfill. Clay-containing foam cured at 1000F or non-clay-containing foam cured at room temperature were suitable for landfills that were not excessively alkaline. Castable cured at 1000F was suitable for alkaline landfills. (Small-FIRL)
W79-06371

LANDFILL DISPOSAL OF HAZARDOUS WASTES; A REVIEW OF LITERATURE AND KNOWN APPROACHES,
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
T. Fields, and A. W. Lindsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 079, Price codes: A03 in paper copy, A01 in microfiche. Report EPA/530/SW-165, 1975. 36 p, 1 fig, 4 tab, 32 ref, 1 append.

Descriptors: *Landfills, *Ultimate disposal, Injection wells, *Chemical wastes, Groundwater, *Hazards, Radioactivity, *Solid wastes, Incineration.

A review is presented of conventional sanitary landfilling, the chemical waste landfill, and alternatives to chemical waste landfill disposal. Research, development, and demonstration programs in hazardous waste land disposal are discussed. Hazardous wastes are categorized as toxic chemical, radioactive, flammable, explosive, or biological. Existing industrial waste landfills are described. Site design and preparation are considered including liners, pH adjustments, cover materials, and observation/monitoring wells. Various waste preparation methods are described including chemical fixation, volume reduction, waste segregation, detoxification, degradation, and encapsulation. Alternatives to chemical waste landfills such as incineration, deep well injection, ocean dumping, and detonation. (Small-FIRL)
W79-06374

LAND APPLICATION OF WASTE MATERIALS FROM DREDGING, CONSTRUCTION, AND DEMOLITION PROCESSES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. R. Lee, R. M. Engler, and J. L. Mahloch.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 842, Price codes: A03 in paper copy, A01 in microfiche. Final Report, 1976. 43 p, 9 fig, 6 tab, 42 ref.

Descriptors: *Construction, *Dredging, Landfills, Waste disposal, *Ultimate disposal, Environmental engineering, *Costs, Recreation facilities, *Environmental effects.

Land application of wastes generated by dredging and by construction and demolition is discussed. The physical and chemical characteristics of the waste materials are described. Potential uses for these materials are discussed including agricultural production, land improvement, wildlife habitat development, recreational facilities, and industrial and residential landfill. Environmental impacts and social and psychological concerns are considered. Information on which dredged material and land application sites are compatible coupled with sound scientific management should achieve productive uses of dredged material that are economically feasible and environmentally sound. (Small-FIRL)
W79-06377

MULTIMEDIUM MANAGEMENT OF MUNICIPAL SLUDGE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 093, Price codes: A10 in paper copy, A01 in microfiche. Report 1977. 202 p, 7 fig, 23 tab, 187 ref, 1 append.

Descriptors: *Ultimate disposal, *Sludge disposal, *Municipal wastes, *Decision making, *Environmental effects, Waste water treatment, Metals, Toxicity, Costs, Performance.

Methods available for managing municipal waste water treatment residuals are reviewed. The disposal or reuse of sludge in three environmental media is considered: ocean, land, atmosphere. Sludge management options are compared in terms of their primary impacts, intermedium effects, risk of environmental damage, technical reliability, direct and indirect costs, and status in regard to present environmental regulation. These comparisons are used to outline a general approach to decision making in sludge management. The final stages of the waste water treatment system are emphasized, but the study also examines the potential for lowering the concentration of metals and other toxic materials in sludge through source control and pretreatment of industrial wastes. (Small-FIRL)
W79-06379

5F. Water Treatment and Quality Alteration

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
For primary bibliographic entry see Field 5A.

W79-06007

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
For primary bibliographic entry see Field 6B.
W79-06008

WATER TREATMENT: TASTE AND ODOR.
Ground Water Age, Vol 12, No 11, p 25, 26, 30, July, 1978.

Descriptors: *Water treatment, *Taste, *Odor, *Turbidity, *Palatability, Aesthetics, Organic matter, Dissolved gases, Dissolved minerals, Activated carbon, Filtration, Chlorination, Potable water.

Factors affecting palatability in drinking water include taste, odor and turbidity. Organic matter is the chief cause of bad taste and odor in water. Sources of organic matter are algae, industrial wastes, and decaying organic matter. They can be treated by filtration through a bed of activated charcoal or by hypochlorination. Dissolved gases are another major source of bad taste and odor in water. The most common gas, hydrogen sulfide, imparts a rotten egg smell to water and causes it to be highly corrosive. Hydrogen sulfide can be removed with either an activated charcoal filter or an oxidizing filter. Dissolved minerals cause a bad taste but do not affect odor. Iron and manganese create a sharp metallic taste and stain clothing, plumbing fixtures and food. Highly alkaline water may have a soda taste. Various neutralizing methods are available to lower the pH. Excess sulfate content is common in water in some areas of the country. A demineralizing filter should be used for drinking water with this problem. Turbidity is caused by small insoluble particles suspended in the water. Although they may be harmless, odorless and tasteless, they still are unsightly. Turbidity can be removed by mechanical filtration or coagulation. (Purdin-NWWA)
W79-06015

EVALUATION OF SORBENTS AS ORGANIC COMPOUND ACCUMULATORS,
Ames Lab., IA.
C. D. Chriswell, J. S. Fritz, and H. J. Svec.
Available from the National Technical Information Service, Springfield, VA 22161 as IS-M 123, Price codes: A04 in paper copy, A01 in microfiche. 1977. 9 p, 1 fig, 4 tab, 6 ref.

Descriptors: *Sorption, *Activated carbon, Water purification, *Resins, Organic matter, Properties, *Municipal water, Potable water, Water treatment.

Sorptive properties of fifteen activated carbons and synthetic resins were evaluated by comparing recovery of organic materials to results obtained with XAD-2 resin. The test sorbents included three polystyrene-divinylbenzene (PS-DV) macroreticular resins, two acrylic ester macroreticular resins, one phenol-formaldehyde absorbent, three week-base anion exchange resins, six activated carbons, and one carbonaceous resin. Four municipal water supplies were sampled using parallel sorption columns. The highest recoveries were obtained using the PS-DV macroreticular resins. Recoveries were lower from acrylic ester macroreticular resins than from PS-DV resins but were higher than from other sorbents. Recoveries from activated carbons were generally quite low. (Small-FIRL)
W79-06037

PROBLEM DEFINITION STUDY: PRODUCTION AND TESTING OF PYROGEN-FREE WATER UNDER FIELD CONDITIONS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. Barkley, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 033, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7612, November 1976, 30 p. 86 ref, 2 append.

Descriptors: *Pyrogens, *Water purification, *Pharmacy, *Limulus Amebocyte Lysate test, *Public health, *Endotoxins, *Methodology, *Water treatment, Pyrogen-free water, Activated carbon, Potable water, Medicine, Bioassay, MUST Pharmacy Modules, Chlorination, Bacteria, Gram-negative bacteria, Costs, Testing procedures, Fever, Microorganisms, Algae, Toxicity, Poisons, Ultraviolet radiation, Ozone, Sterilization, Military aspects.

The best water treatment system for pyrogen removal from potable water for pharmaceutical applications and subsequent testing of purified water under field conditions (particularly military) consists of ion-exchange, carbon absorption, UV irradiation, and ozonation; the Limulus Amebocyte Lysate test (LAL) is the preferable testing method. Pyrogens, derived from certain metabolic by-products of bacteria, molds, some yeasts, viruses, and algae, and from certain chemicals, cause fever when injected into mammals, though not when ingested. Chemical pyrogens are removed by standard water treatment practices, but progens pass through most bacterial filters. Biological pyrogens are often referred to as endotoxins; the most potent are derived from gram-negative bacteria. Distillation, the most widely used method of pyrogen removal, is the most costly: production of 100 gal pyrogen-free water in 16 hrs requires 18.2 kw electricity and 0.9 gal cooling water/min., while the recommended system would consume less than 0.5 gal/min cold water and no more than 3 kw. The rabbit test is the only test recognized by the US Pharmacopeia (USP), but in field uses, such as in the Pharmacy Module of MUST-equipped hospitals, disadvantages include the need to maintain test animals, three-hr duration, and requirement of skilled personnel. The LAL test is commercially available, rapid, simple, and specific, though it is pH; temperature; and agitation-dependent. This test uses the blood cell (amebocyte) of the horseshoe crab (Limulus polyphemus). (Lynch-Wisconsin)
W79-06044

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 150, Price codes: A05 in paper copy, A01 in microfiche. Report No EPA-905/2-77-004, October 1977. 89 p, 4 fig, 5 append.

Descriptors: *Treatment facilities, *Sewage treatment, *Planning, *Evaluation, Social aspects, Economic evaluation, Environmental effects, Cost analysis, Waste water treatment, Waste disposal.

A working document of a general nature intended to assist in the preparation of facility plans for construction of municipal sewage treatment works is presented. Environmental, social, and economic evaluation are viewed as an integral part of the facilities-planning process and should be performed throughout the process. A cost-effective analysis is defined as a systematic comparison of alternative ways of dealing with waste water treatment and disposal problems to identify the solution which will minimize total costs to society; these costs are monetary and environmental. Guidelines are presented for an inventory of the existing environment, the development of alternatives, and evaluating the environmental impact. (Davison-IPA)
W79-06095

MONOGRAPH ON CARBON: ACTIVATED CHARCOAL,
Informatics, Inc., Rockville, MD.
R. W. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 129, Price codes: A03 in paper copy, A01 in microfiche. Report No. FDA/BF-78/90, October 18, 1977. 41 p, 3 fig, 10 tab, 141 ref. FDA 223-76-2001.

Descriptors: *Carbon, *Activated carbon, *Filtration, *Water purity, *Water purification, Absorption, Waste water treatment, Data collections, Physical properties, Water pollution treatment.

The available scientific literature from 1920 to 1977 on carbon (activated charcoal) is summarized. In addition to being used as an antidote to poison, activated charcoal has been used in sugar refining, brewing, and as a filter in the purification of many products such as gelatin, lard, oils, fats, sorghum syrup, fruit juices, and water for the soft drink industry. Chemical information, biological data, and the biochemical aspects of carbon are given. (Davison-IPA)
W79-06104

DEVELOPMENT AND TESTING OF BREADBOARD ELECTROCHEMICAL ORGANIC CONTENT ANALYZER,
Life Systems, Inc., Cleveland, OH.
R. J. Davenport, and R. A. Wynveen.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 557, Price codes: A04 in paper copy, A01 in microfiche. Annual Report 1977. 69 p, 33 fig, 7 tab, 7 ref.

Descriptors: *Analytical techniques, *Instrumentation, Electrolytes, *Electrodes, *Adsorption, *Solutes, Organic wastes, Performance, Monitoring, Ozone, Disinfection, Water treatment, Water purification.

The Breadboard Electrochemical Organic Content Analyzer was developed to be interfaced with the Water Processing Element Pilot Plant and its data acquisition system. The analyzer was designed to monitor organic solute concentrations based on adsorption of the solutes on an indicating electrode, and measurement of the resulting decrease in the electrodes interfacial capacitance. The analyzer was capable of longterm, continuous monitoring of the ozonated effluent. The addition of electrolyte to the sample was an effective means of eliminating measurement errors resulting from changes in the pH and conductivity in the sample. The electrolyte used demonstrated the ability to avoid interferences from 03, Cl(-), NO3(-), and SO4(-2). There was no interference from 02, and there were no temperature effects. (Small-FIRL)
W79-06145

PILOT PLANT STUDIES TO EFFECT CHRYSOTILE ASBESTOS FIBRE REDUCTION DURING POTABLE WATER TREATMENT,
Ontario Ministry of the Environment, Toronto.
R. B. Hunsinger, J. Lawrence, and K. J. Roberts.
Technical Report 67, 1977, 37 p, 1 fig, 3 tab, 12 ref, 3 append.

Descriptors: *Potable water, Water treatment, *Filtration, *Asbestos, *Pilot plants, Turbidity, Efficiency.

Pilot plant studies incorporating conventional potable water pre-treatment and filtration were performed to assess asbestoiform fiber removal. Problems were encountered in consistent fortification of the pilot plant feed water with sufficient asbestos to make measurement of removal possible. Optimized conventional treatment did significantly reduce asbestos levels. Unfortunately, given the current state-of-the-art in counting technology, treatment efficiency cannot be determined accurately. No direct relationship was established between fiber concentration and turbidity, although low fiber concentration was generally associated with low turbidity. (Small-FIRL)
W79-06158

ACTIVATED CARBON ADSORPTION OF TRACE ORGANIC COMPOUNDS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.
V. L. Snoeyink, J. J. McCreary, and C. J. Murin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 253, Price codes: A07 in paper copy, A01 in microfiche. Technical Report EPA-600/2-77-223, 1977. 115 p,

42 fig, 17 tab, 70 ref.

Descriptors: *Adsorption, *Activated carbon, *Organic matter, *Organic compounds, Isotherms, *Humus, *Odor, Potable water, Fluorescence, Water treatment, Humic acids.

Activated carbon adsorption of humic substances and trace contaminants 2-methylisoboreol (MIB), geosmin, the chlorophenols and polynuclear aromatic hydrocarbons (PAH) was investigated under competitive adsorption conditions encountered in natural waters. Isothermal tests and small-scale laboratory columns were used. Humic substances were obtained from a commercial source, well water, leaf extract and soil extract. Significant differences were observed in adsorption, haloform formation potential, and fluorescence. A method for the synthesis of MIB was developed along with a gas chromatographic analytical technique for MIB and geosmin (0.1 microgram/liter). These naturally occurring odorous compounds were more strongly absorbed than humic substances which compete with MIB and geosmin for adsorption sites. Chlorophenols and PAH's were strongly adsorbed. Anionic and neutral species of 2,4-dichlorophenol and 2,4,-6-trichlorophenol competed for adsorption sites even at a concentration of 1 microgram/liter. Except at a pH of 7.0, the observed data conformed to the Langmuir model for competitive adsorption, or the Jain and Snoeyink modification of the Langmuir model. A significant reduction in chlorophenol adsorption capacity resulted with the presence of various humic substances. Also, humic acid did not interfere with the rate of adsorption of anthracene, a model polynuclear aromatic hydrocarbon. (Small-Firl)
W79-06330

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8A.
W79-06337

INACTIVATION OF VIRUSES IN WATER BY BROMINE AND ITS COMPOUNDS: INFLUENCE OF VIRION AGGREGATION,
North Carolina Univ. at Chapel Hill. School of Medicine.
D. G. Sharpe, and J. D. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 622, Price codes: A06 in paper copy, A01 in microfiche. Final Report, 1977, 103 p, 51 fig, 40 ref.

Descriptors: *Viruses, Diseases, *Bromine, *Disinfection, Water purification, Electron microscopy, *Hydrogen ion concentration, *Aggregates, Particle size.

The inactivation of poliovirus and reovirus by bromine in water was investigated. OBr(-) reacted most rapidly with dispersed poliovirus reducing plaque-forming infectivity about 3 log(10) units/sec at a concentration of 9.6 at 2C and pH 11. The rate of inactivation with Br2 at pH 5 was 0.8 log (10) units/sec. Corresponding rates with HOBr, NBr3, and NHBr2 were 0.12, 0.035, and 0.004 log(10) units/sec at pH 7. Reovirus was more sensitive to HOBr than polio virus, but when aggregation was present, reovirus survived bromine treatment that destroyed well dispersed poliovirus. Aggregated preparations of both viruses reacted with HOBr with a continuously decreasing reaction rate. The most resistant units were the larger aggregates. Electron microscopy demonstrated that virus particles are generally aggregated in the crude or unpurified state. Experimental techniques to determine aggregation were developed, and the fate of aggregates in different types of water and at different pH levels, was investigated. (Small-Firl)
W79-06338

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
For primary bibliographic entry see Field 5D.
W79-06340

CRITERIA FOR THE PRODUCTION OF HIGH PURITY WATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. McCarthy.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 032, Price codes: A04 in paper copy, A01 in microfiche. Technical Report 7714, 1977. 63 p, 18 tab, 67 ref.

Descriptors: *Specifications, Water quality, *Water purification, *Laboratories, *Hospitals, Ion exchange, Reverse osmosis, Distillation, Filtration, Adsorption, *Water pollution.

Information is presented which should be considered during the design or specification of high purity water production systems in health care facilities and laboratories. Water quality is discussed, and summaries of commonly used water quality criteria are presented. Design considerations are discussed for ion exchange, reverse osmosis, distillation, filtration, and carbon adsorption techniques. Design considerations for the distribution and storage of high purity water are discussed including construction materials and centralized versus decentralized systems. Water quality should be monitored periodically to ensure suitability for use and to make possible the detection of contaminants developed during production, storage, and distribution. (Small-FIRL)
W79-06354

ALTERNATIVES TO CHLORINATION FOR CONTROL OF CONDENSER TUBE BIOFOULING,
Monsanto Research Corp., Dayton, OH.
H. H. S. Yu, G. A. Richardson, and W. H. Hedley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 269, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/7-77-030. March 1977. 74 p, 14 fig, 9 tab, 28 ref.

Descriptors: *Cooling water, *Fouling, *Powerplants, *Chlorination, *Water treatment, Bromie, Ozone, Iodine, Radiation, Cleaning, Condensers.

Better techniques of chlorination or alternatives to chlorination of power plant effluent for preventing bio-fouling in cooling systems, especially condenser tubes, were evaluated. The assessments were directed toward reducing free-chlorine residuals in effluent released into receiving waters where chlorinated compounds may have toxic effects on aquatic microorganisms or may enter drinking water supplies. Parameters evaluated and compared in the study included: technical feasibility; environmental effects; engineering problems; relative capital, operational, and chemical costs; actual dollar costs; and present state of technology. Chemical applications evaluated for treating fresh or marine cooling water in once-through or closed cycle systems included: chlorine, bromine, chloride, iodine, ozone, chlorine dioxide, hypochlorite, and controlled-release pesticides. On-line mechanical cleaning of condenser tubes in cooling systems were also considered; these included the utilization of sponge rubber balls, bruch devices, or hot water backflushing. Ultraviolet and gamma radiation were evaluated as physical-chemical treatments. Improved procedures of chlorination as alternatives to continuous chlorination included: dosing at the inlet of condensers, serially; dechlorination; chlorination by feedback control of residuals; and blowdown timing control. (Lisk-FIRL)
W79-06358

OIL/WATER SEPARATION STATE-OF-THE-ART,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
F. A. Osamor, and R. C. Ahlert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 755, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-069, 1978. 104 p, 10 fig, 4 tab, 176 ref.

Descriptors: Oil industry, *Evaluation, *Oil pollution, Oil wastes, Oily water, Oil-water interfaces, *Separation techniques, Water quality control, *Testing, Ships.

The state-of-the-art of oil and water separation devices and processes was investigated. The technology available for shipboard and shoreside treatment of bilge and ballast waters and the oily waste water associated with crude oil production was considered. Separation devices were classified according to the primary mechanisms that induce separation of oil/water mixtures. The basic concepts of each class of equipment, design features, operational conditions, and device limitations are discussed. Literature on test evaluation of devices was critiqued on the basis of actual or potential success in treating various oil/water systems. No single technique can separate all oil/water system states efficiently. (Small-FIRL)
W79-06360

A THEORY ON WATER FILTRATION, PART I: BACKGROUND,
Civil and Environmental Engineering Development Office, Tyndall AFB, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 387, Price codes: A03 in paper copy, A01 in microfiche. Report CEED0-TR-77-1, 1977. 34 p, 2 fig, 1 tab, 49 ref, 1 append.

Descriptors: *Filtration, Aerosols, *Efficiency, Water treatment, *Mathematical models, Flow, Suspended solids.

Background is given for a project which applied existing theoretical concepts used in aerosol mechanics to various water filtration systems. Equations were developed to describe the water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. Information is presented on small particle collection, air filtration efficiency, and the effects of flow, pressure, and time. (See W79-06388 and W79-06389) (Small-FIRL)
W79-06387

A THEORY ON WATER FILTRATION PART II. MODEL PRESENTATION,
Civil and Environmental Engineering Development Office, Tyndall, AFB, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 607, Price codes: A02 in paper copy, A01 in microfiche. Report CEEDO-TR-77-2, 1977. 18 p, 1 fig, 24 ref.

Descriptors: *Filtration, Aerosols, Water treatment, *Efficiency, Sands, *Mechanical properties, *Suspended solids, Mathematical models.

Existing theoretical concepts used in aerosol mechanics were applied to various water filtration systems. These equations were then used to described water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. The model integrates numerically to determine the pressure drop caused by the sand, the suspended particles collected in the sand, and the filter efficiency for both the sand and the suspended particles (the cake) at different time increments. Also, it computes the average efficiency from the start to any point in the filter cake. The sand bed and filter cake characteristics are then modified for each increment to reflect the net change in their characteristics caused by particles collected during the previous integration increment. (See also W79-06387) (Small-FIRL)
W79-06388

A THEORY ON WATER FILTRATION, PART III - SENSITIVITY ANALYSIS, DATA EVALUATION AND CONCLUSIONS,

Civil and Environmental Engineering Development Office, Tyndall Air Force Base, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 290, Price codes: A03 in paper copy, A01 in microfiche. Report CEEDO-TR-77-3, 1977. 37 p, 5 fig, 8 tab, 61 ref.

Descriptors: *Filtration, Aerosols, Water treatment, *Efficiency, Sands, Mechanical properties, *Suspended solids, *Mathematical models, Flow.

Existing theoretical concepts used in aerosol mechanics were applied to various water filtration systems. These equations were used to describe water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. These models were examined from the standpoint of their interrelated parameters and their applicability to known filtration data. The sand filtration model demonstrated a potential to predict the relationship between flow, pressure, time, and efficiency. Data validation of the model indicated that its predictions were within the range of predictions made by classical water filtration models for typical data ranges. Also, the new model could predict filter efficiency for a wide range of fluid-particle suspensions and filter media. (See also W79-06387) (Small-FIRL)
W79-06389

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN NEW MEXICO,
Southwest Research Inst., San Antonio, TX.
For primary bibliographic entry see Field 3A.
W79-06428

5G. Water Quality Control

EXPERIMENTS AIMED AT THE REMOVAL OF PHOSPHATE BY ELECTROCHEMICAL METHODS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5D.
W79-06033

EFFECT OF DRAINAGE SYSTEM DESIGN AND OPERATION ON NITRATE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs, and J. W. Gilliam.
Paper No. 78-2501, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, IL. 13 p. 9 fig, 3 tab, 18 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Nitrates, Simulation analysis, *Drainage effects, Drainage systems, Drainage water, Surface drainage, Subsurface drainage.

Simulations were conducted to predict NO3(-) movement from artificially drained soils. Effects of alternative drainage designs and operational procedures on NO3(-) outflow to drainage waters were presented. (Skogerboe-Colorado State)
W79-06036

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, D. E. Smika, and D. F. Heermann.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineering, Vol 104, No 1R3, p 283-291, September, 1978. 6 fig, 2 tab, 8 ref.

Descriptors: *Irrigation programs, *Water pollution, *Leaching, *Nitrates, Fertilizers, Denitrification, Water management, Groundwater.

A partial analysis is presented of the results of studies on the effects of irrigation practices on the movement of water and nitrate toward the water table. The study area was an alluvial valley of the South Platte River near Crook, Colorado. Four sandy plots, irrigated with center pivot sprinkle systems, were instrumented to measure directly all components of the water budget during the growing season. Vacuum extractors were installed beneath each plot to measure deep percolation. Water samples for NO3-N analysis were collected periodically from each extractor, from irrigation and stock wells, and from piezometers. Soil samples were also collected. Three of the plots were irrigated according to the USDA irrigation scheduling program. A fourth plot was irrigated nearly continuosly which resulted in leaching of significant amounts of NO3-N beyond the root zone. A high concentration of 50 ppm was found near the water table but decreased rapidly with depth. This may be due to the denitrification effect of microbial activity or ferrous iron in the anaerobic region of the aquifer. If significant denitrification occurs, the potential for groundwater pollution by leached nitrates is considerably reduced. However, careful water management remains an important factor in the irrigation program. (Purdin-NWWA)
W79-06081

THE INTEGRITY OF WATER,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 238, Price codes: A10 in paper copy, A01 in microfiche. Proceedings of a Symposium, March 10-12, Washington, DC, 223 p, 84 fig, 10 tab, 153 ref. Environmental Protection Agency, Washington, DC.

Descriptors: *Water quality, *Federal Water Pollution Control Act Amendments of 1972, Environmental effects, Human population, Groundwater, Surface waters, Physical properties, Chemical properties, Biological properties.

The twenty-two papers presented at an invitational symposium focus on the definition and interpretation of water quality integrity as viewed and discussed by representatives of State governments, industries, the academic community, conservation and environmental groups and the general public. The quantitative and qualitative characteristics of the physical, chemical, and biological properties of surface and groundwater were addressed. (Davison-IPA)
W79-06103

GREAT LAKES RESEARCH ADVISORY BOARD ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
1978. 64 p, 1 fig, 2 tab, 30 ref.

Descriptors: Great Lakes region, *Great Lakes, *Toxins, Water pollution, *Phosphorus, Water quality standards, *Ecosystems, *Data storage and retrieval, Dredging, Solid wastes, Water quality.

The past activities of the principal scientific advisor to the Commission on Great Lakes water quality (US-Canada) are discussed as they relate to three concerns: toxic substances, water quality and the Great Lakes ecosystem, and phosphorus limitations. Governments are requested to coordinate efforts to identify existing data bases and develop new data bases with information on physical, chemical, and toxicological data. An immediate joint effort to review and assess alternative dredged material disposal policies is recommended. Also, a recognized policy is needed for an ecosystem approach to water quality management. Further, studies are recommended to determine the most cost-effective programs for reducing phosphorus loadings. (Small-Firl)
W79-06125

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
1978. 89 p, 6 fig, 20 tab.

Descriptors: *Great Lakes region, *Legislation, *Water quality, Regulation, Priorities, Toxicity, *Chemical wastes, Public health, Environmental effects, Governments.

Progress by the Great Lakes Water Quality Board toward compliance with the original 1972 Water Quality Agreement is discussed. Recent water quality, remedial programs, legislation, and water quality board activities are described. A review is presented of previous assessments and recommendations of the Water Quality Board, and water quality objectives. Due to the presence of low concentrations of toxic chemicals, the board recommends that governments develop rational schemes to order priorities for evaluating the risk of toxic chemicals to human health and environment. It is also recommended that governments initiate programs to control the production, use and disposal of chemicals that are potentially toxic. (Small-FIRL)
W79-06129

CRITERIA OF WATER QUALITY IN RELATIONSHIP WITH THE FINAL USE OF THE RECEIVING BODY AND ITS ASSIMILATION CAPACTIY (CRITERIOS DE CALIDAD DEL AGUA EN RELACION CON EL USO FINAL DEL CUERP RECEPTOR Y SU CAPACIDAD DE ASIMILACION),
Esso S.A.P.A., Argentina.
A. H. Torrea, E. Alvarez, N. E. Catarineu, and L. Peisojovich.
ATIPCA (Asociacion de Tecnicos de la Industria Papelera y Celulosica Argentina), Vol. 17, No. 2, p 2, 6-10, 12, 16-18, 20-21, 1978. 20 ref.

Descriptors: *Water quality, *Waste assimilative capacity, *Surface waters, Water quality control, South America, Argentina.

The application of water quality criteria based on the final use of the receiving water body and its assimilation capacity permits establishing levels of quality resulting in reduced effluent treatment requirements. Concepts are developed on the determination of the final use of a receiving body. Methodology is analyzed for establishing the assimilation capacity of the receiving body through various formulae. Taking these aspects into account, methods are suggested for evaluating the cost-benefit relationship in making a decision with the object of utilizing to the maximum the particular conditions of a receiving water body. A regional system for water quality control in Argentina is proposed. (Speckhard-IPC)
W79-06143

EFFICIENT AMENDMENT USE IN SODIC SOIL RECLAMATION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
R. J. Prather, J. O. Goertzen, J. D. Rhoades, and H. Frenkel.
Soil Science Society of America Journal, Vol 42, No 5, p 782-786, September-October, 1978. 8 fig, 5 tab, 9 ref.

Descriptors: *Reclamation, Alkali soils, *Soil amendments, Calcium sulfate, Gypsum, Calcium chloride, Sodium, *Leaching, Regression analysis.

A laboratory column study of sodic soil reclamation was carried out using two soils high in exchangeable sodium percentage (ESP) and cation exchange capacity (CEC). Three amendments ($CaSO_4.2H_2O$, $CaCl_2.2H_2O$, and H_2SO_4) were used singly and in combination to test their effectiveness and efficiencies with respect to amount of amendment, time, and leaching needed. As a single amendment, H_2SO_4 was more effective than $CaSO_4$ and results in a more desirable ESP profile than $CaCl_2$. Combining either $CaCl_2$ or H_2SO_4 with $CaSO_4$ (proportions of 1/4 and 3/4, respectively) appreciably reduced the time and leaching needed to achieve reclamation as compared with $CaSO_4$ alone. It was observed that certain soil conditions preclude or make undesirable the use of $CaSO_4$ alone and combining amendments results in effective reclamation and a potential savings in amendment costs. (Skogerboe-Colorado State)
W79-06150

DETERMINING WATER QUALITY CRITERIA FOR WATER FLOW IN SOLVING THE PROBLEMS OF CONTROLLING WATER POLLUTION,
Kh. A. Velner, V. I. Gurariy, and A. S. Shayn.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 193-205 (Discussion p 206-207), September 1978. 1 fig, 3 tab, 14 ref. EPA-600/9-78-024.

Descriptors: *Water pollution control, *Flow, *Water quality criteria, *Soviet Union, Effects, Assessment, Equations, Questionnaires, Decision making, Water bodies, Classification, Statistical methods.

In the Soviet Union, water quality improvement is considered one of the most important economic and political problems at the present stage of social development. Needed are methods for the objective assessment of water quality. First, water quality must be defined quantitatively; developing a state system of quality control includes problems of planning, forecasting and optimization. Information based only on water quality evaluation by individual properties does not provide an adequate problem solution. Laws in the USSR set maximum permissible concentrations for harmful substances in impoundments and water courses and define the water quality in a reservoir for drinking water, recreation, and fish breeding. However, some deficiencies have been found in the existing criteria for water quality assessment from the design and maintenance of water installations. The decision-making procedure is not purely mathematical in character, having certain psychological attributes. VNIIVO's mathematical modeling lab distributed a questionnaire among experts, selecting the most significant parameters and evaluating them on a five-point system. The mean statistical value for each parameter, the frequency of possible maximum estimates, sum of ranks, and also probability characteristics, variance coefficient, concordance coefficient, and the statistical significance of the level of agreement among the experts were determined. Needed is a common system of water quality indexing. The application of analytical-expert methods allows establishment of a common approach to the problem of developing water quality criteria for water management systems. (See also W79-06166) (Bell Graf-Cornell)
W79-06174

EFFECTS OF CHANNEL DAMS ON DISSOLVED OXYGEN CONCENTRATIONS IN NORTHERN ILLINOIS STREAMS,
Illinois State Water Survey, Urbana.
T. A. Butts, and R. L. Evans.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 924, Price codes: A08 in paper copy, A01 in microfiche. Circular 132, 1978. 153 p, 6 fig, 6 tab, 14 ref, 1 append.

Descriptors: *Reaeration, *Streams, *Illinois, *On-site investigations, Dissolved oxygen, Water quality, Dams, Aeration, Data collections, Overflow, Spillways, Analytical techniques, Methodology.

This study was performed for the Northeastern Illinois Planning Commission (NIPC) to provide data for input into a comprehensive water quality model being developed for NIPC in conjunction with their Areawide Waste Treatment Management Study. The principal objective of this study was to gather physical data concerning the aeration characteristics of the dams for use in calibrating weir formulas developed in Great Britain. This entailed measuring upstream and downstream DOs and temperatures for extended time periods and determining the physical measurements and characteristics of the dams. In all, 53 different structures exist at 48 locations on study area streams. At 5 of those locations, 2 different spillway or release structures exist side by side. Forty of the 53 structures were sampled at 15-minute intervals for at least 4-hour segments. Detailed results observed and recorded in the field were presented in the appendix. Two photographs were shown for some structures to illustrate structural details more clearly or to show different flow conditions. It was concluded that most channel dams and weirs studied significantly affect water quality in almost all major study area streams. These effects should be incorporated into any mathematical model dealing with dissolved oxygen. This report was prepared for use as a preliminary guide. (Humphreys-ISWS)
W79-06234

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
C. W. Heckroth.
Water and Wastes Engineering, Vol. 15, No. 12, p 22-27, 30, December, 1978.

Descriptors: *Water pollution control federation, *Water quality control, *Integrated control measures, *Conferences, Toxins, Sludge disposal, Industrial wastes, Water reuse, Research priorities, Consolidation, Permits, Grants.

At the annual Water Pollution Control Federation meeting many topics were discussed. Among them were state-federal Environmental Protection Agency (EPA) agreements, pretreatment standards, toxic pollutants, national municipal policy and strategy, '208' programs, future legislation, Congress-EPA conflicts, water reuse, managing grants and permits, and a national research program. Speakers' conclusions are provided. One speaker said the EPA intends to consolidate its efforts by requiring each EPA region to enter into an annual agreement with its respective states covering all water and solid waste programs. Pretreatment standards for industrial plans are detailed herein. Control of toxic pollutants will be receiving more emphasis in the future and should constitute a major factor in formulating a national research program. Water reuse is being given top priority. Some ways in which EPA is encouraging water conservation are discussed. There is also a need to coordinate management of federal construction grants to municipalities, to insure compliance with the terms and stipulations of a community's National Pollutant Discharge Elimination System permit. The funding strategy for section 208 of the Clean Water Act is discussed. The '208' program gives state and area-wide agencies funds for implementing water quality management plans. (Horwich-Florida)
W79-06297

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-06308

PERFORMANCE TESTING OF OIL MOP ZERO RELATIVE VELOCITY OIL SKIMMER,
Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ.
M. K. Breslin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 232, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/7-78-060, 1978. 20 p, 7 fig, 2 tab, 2 append.

Descriptors: *Skimming, *Oil spills, Water pollution control, Oily water, *Prototypes, *Testing, *Separation techniques, Adsorption, Performance, Running waters, Mechanical equipment.

A fast current prototype skimmer designed and built by OMI with an operating range up to 3 m/sec, was tested. Oil was adsorbed onto oleophilic fibers woven into a rope. The rope and fibers were then squeezed by wringers to remove the oil. The device was operated in a controlled oil slick and monitored for oil recovery. Controlled independent variables included operating speed, oil slick thickness, tow speed, and wave conditions. Fluid recovery was sampled during and after the test run to determine skimmer performance. Results were evaluated in terms of recovery rate, recovery efficiency, and throughput efficiency. Only eight oil-collection test runs were made over two days because of adverse weather and problems with the device. Thus, parameters could not be completely optimized. (Small-FIRL)
W79-06359

PERFORMANCE TESTING OF THREE OFF-SHORE SKIMMING DEVICES,
Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ.
H. W. Lichte, and M. K. Breslin.
Report EPA-600/7-78-082. 1978. 77 p, 24 fig, 30 tab, 3 append.

Descriptors: *Oil spills, Oil pollution, *Testing, *Skimming, Mechanical equipment, *Performance, Evaluation, Waves(Water), Weather, Oceans.

Three off-shore skimming devices were evaluated as part of the assessment and evaluation of technology and procedures for controlling and cleaning up oil spills in the marine environment. Throughput efficiency, recovery efficiency, and oil recovery rate, were determined for the Cyclonet 100, MARCO class V Oil Skimmer, and the U.S. Coast Guard Skimming Barrier (CGSB). Test variables included several wave conditions and tow speeds to simulate harbor and offshore environments. Performance was maximum at speeds through the water of 1.5 m/sec or less, even in calm water. As wave conditions become more severe, performance deteriorates. Even relatively low breaking waves render the pickup devices effectively useless. Performance was better using the heavier of the two oils tested. Thus, effective use of the equipment depends on extremely favorable weather conditions. Further research and development are needed to establish effective cleanup methods which are effective in more severe sea conditions. (Small-FIRL)
W79-06365

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

AMERICAN-SOVIET SYMPOSIUM ON USE OF MATHEMATICAL MODELS TO OPTIMIZE WATER QUALITY MANAGEMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 696, Price codes: A20 in paper copy, A01 in microfiche. Proceedings: Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Florida, September 1978. EPA 600/9-78-024, 453 p.

Descriptors: *Water quality, *Water pollution control, *Mathematical models, *River basins, *Simulation analysis, *Methodology, *United States, *USSR, Eutrophication, Ecosystems, Lakes, Management, Decision making, Forecasting, Water bodies, Systems analysis.

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

The American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management examines methodological questions related to simulation and optimization modeling of processes that determine water quality of river basins. Discussants describe the general state of development and application of mathematical models designed to predict and optimize water quality management in the USA and USSR. Subjects of papers presented by American and Soviet specialists include: planning comprehensive water quality protection systems; modeling water quality in river basins; geographic-economic aspects of pollution control systems; identification of ecosystem models by field data; management decisions for lake systems on a survey of trophic status, limiting nutrients, and nutrient loadings; a descriptive simulation model for forecasting the condition of a water system; mathematical ecosystem models and a description of the water quality in water bodies; mathematical modeling strategies applied to Saginaw Bay, Lake Huron, to eutrophical processes in Lake Ontario, to hydrodynamics and dispersion of contaminants in the nearshore, and to coastal currents in large lakes; and the construction of a model of Lake Baikal on the principles of self-organization. Publication of the proceedings held December 9-16, 1975, in Kharkov and Rostov-on-Don, USSR, is in compliance with the Memorandum from the Fourth Session of the Joint American-Soviet Committee on Cooperation in the Field of Environmental Research. (See W79-06167 thru W79-06184) (Bell-Graf--Cornell)
W79-06166

PLANNING COMPREHENSIVE WATER QUALITY PROTECTION SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
D. P. Loucks.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 1-33, September 1978. EPA-600/9-78-024. 3 fig, 15 ref.

Descriptors: *Comprehensive planning, *Water quality, *Protection, *Economic efficiency, *Optimization, *Simulation analysis, *Analytical techniques, *Model components, *USSR, *Cost minimization, Constraints, Mathematical models, Systems analysis, Mixed-integer programming, Linear programming, Nonlinear programming, River basins, Waste water(Pollution), Flow augmentation, Aeration, Land disposal.

This paper outlines several approaches to water protection modeling, emphasizing problem definition and model development. Reviewed is a number of mathematical modeling components which can be combined and solved for the preliminary planning of minimum cost, comprehensive water quality management programs for river systems. The techniques considered hopefully reflect an approach to long-run water quality protection planning that might be appropriate for various rivers in the USSR. The use of both optimization and simulation models permits the identification of those particular measures, their design specifications, and their operating policies, that will satisfy water quality, economic, and possibly other objectives. The optimization techniques herein have been developed for: wastewater treatment facilities; wastewater effluent storage lagoons; land disposal sites for wastewater disposal and additional treatment; flow augmentation reservoirs; and in-stream aeration devices. The models are static. Discussed are nonlinear, linear, separable, and mixed-integer programming, the last being recommended as the solution technique. The systems models and methods illustrated herein are not substitutes for judgment, but rather are aids to it in providing information and opportunities that otherwise might not be available. (See also W79-06166) (Bell-Graf--Cornell)
W79-06167

OPTIMIZATION OF WATER QUALITY CONTROL IN A RIVER BASIN,
A. K. Kuzin.
In: American Soviet Symposium on Use of Mathematical Model to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 36-52, September 1978. EPA-600/9-78-024. 2 fig, 12 ref.

Descriptors: *Water quality, *Protection, *River basins, *Optimization, *Methodology, *Mathematical models, *Decision making, Effluents, Treatment, Lagoons, Flow autmentation, Investment, Long-term planning, Analytical techniques, Systems analysis, Equations.

Water quality is considered in the development of a long-term optimum strategy determining capital investment policy in the USSR. The basin water protection programs, part of the nation's overall water protection program, are based on strategic objectives for 10 to 15 years. Weighty socio-economic prerequisites favor the basin approach to the control of water quality-effect factors. There are at least two ways of constructing an economic-mathematical model for optimization of anti-pollution measures on a drainage basin scale: construction of a united 'super-model' or a system of small mutually matched models. A number of serious shortcomings of a practical nature limit the use of 'super-models'. Optimization problems in the field of water protection are divided into three classes: Class 1 - problems of optimizing functionally different technical facilities; Class 2 - problems of interaction of differing facilities; and Class 3- problems of optimizing operationally different technical solutions. Investigation of relations among these has shown that during the optimization of water protection measures within the limits of a basin or basin section, a multilevel system of models can be developed, requiring a multilevel approach. Discussed are the stages in solving an optimization problem, and typical optimization problems for water protection measures are described. Widespread use of the decision-making optimization methodology outlined herein will yield high economic profits to the national economy. (See also W79-06166) (Bell-Graf--Cornell)
W79-06168

WATER QUALITY MANAGEMENT MODELS: SPECIFIC CASES AND SOME BROADER OBSERVATIONS,
Meta Systems Inc., Cambridge, MA.
R. J. DeLucia, and T. Chi.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 92-124, September 1978. EPA-600/9-78-024. 9 fig, 1 tab, 28 ref.

Descriptors: *Water quality, *Management, *River basins, *Planning, *Mathematical models, Optimization, Constraints, Pollutants, Treatment facilities, Costs, Biochemical oxygen demand, Dissolved oxygen, Constraints, Timing, Equations, Systems analysis, Capacity expansion, Cost minimization, Linear loss function, Convex separable programming, Size, St John River basin model, Descriptive modeling, Prescriptive model.

There is no one prescribed approach for model building for investment planning in water quality control. The development of a water quality model is dependent on the characteristics of the problem being examined. Considered herein are four areas of concern that influence model development: (1) the relationship of planning activity to the problems of variable specifications; (2) the nature of the institutional or client setting; (3) the type and quality of data available for model development; and (4) the availability of resources for model development and implementation. Discussed is the Saint John River basin model, whose development provides an example in which many important issues in these four areas arise; highlighted are the most significant issues. The notable features of the discussions which led to the development of th model in its present form are considered. Discusse in detail is the need to calibrate/verify the descrip tive relationships in water quality modeling. It concluded that there are two types of applicatio or implementation problems associated with th use of water quality planning models: (1) accept ance of a descriptive or prescriptive model for us in an actual water quality planning study and (2 the implementation of a water quality plan that i based at least partially on a study in which a mode has been used. It is recommended that a wast discharger be required to provide evidence t show his innocence in polluting, regarding an discharge believed to be harmful to the environ ment, instead of the present procedure whic allows the polluter to be regarded innocent unti proven guilty. An example of optimal capacity expansion of treatment facilities is given. (See also W79-06166) (Bell-Graf--Cornell)
W79-06170

MODELING AND DECISION-MAKING AS PECTS OF WATER QUALITY MANAGEMENT
Environmental Protection Agency, Washington DC. Water Planning Div.
M. A. Pisano.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 180-190 (Discussion 191-192), September 1978. 2 fig, 3 tab. EPA-600/9-78-024.

Descriptors: *Water pollution control, *Decision making, *Mathematical models, *Water quality analysis, Planning, Evaluation, Dissolved oxygen, Evaluation, Rivers, United States, Methodology, Systems analysis.

This paper gives an overview of how approaches and concepts considered in several of the papers presented at this symposium may be utilized in the solution of complex water quality problems. These papers discuss key economic and political concepts that are used in the water quality management planning process of the United States. Also, the papers discuss some specific case study applications of these modeling approaches, as well as how some of the major planning concepts were employed in a particular area. Modeling, water quality analysis, and comprehensive planning approaches have played a very fundamental role in the implementation of our Federal Water Pollution Control Program. This paper describes that role and provides an assessment of modeling as it has contributed to our water quality management decisions. Considered is how the above approaches and concepts have been employed as a part of this role. (See also W79-06166) (Bell-Graf--Cornell)
W79-06173

IDENTIFICATION OF ECOSYSTEM MODELS BY FIELD DATA (INVERSE PROBLEMS OF ECOLOGY),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. B. Georgiyevskiy.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 263-279 (Discussion p 280-281), September 1978. 7 ref. EPA-600/9-78-024.

Descriptors: *Ecosystems, *Model studies, *Differential equations, *Field data, *Stochastic processes, *Model parameters, *Integral transformations, Algorithms, Dynamic model, Cartesian coordinates, Water biocenosis, Complete smoothing, Curvilinear orthogonal coordinates, Algebraic equations, Statistical models, Numerical analysis, Systems analysis, Plankton.

Proposed is the construction of ecosystem models to be identified herein on the basis of conventional

differential equations (dynamic models) and in partial derivatives. Identification is the determination of numerical values of coefficients for use in differential equations by first-hand observation of biotic and abiotic components of an ecosystem in a certain region. In ecology, problems of this kind are examined by identifying objects of automatic control. The usual identification method is to select numerical values for the model parameters which minimize the mean square difference between the observed and calculated trajectories. But ecological problems possess traits which hamper this approach. Given are the characteristics of inverse problems in ecology which necessitate identification without using solution of the direct boundary conditions. Proposed is the use of a method which does not use the solution of direct boundary equations; the method can be based on integral transformations of differential equations of ecological models aimed at excluding the experimental functions differential operation. Considered herein are: (1) type of differential equations of water ecosystem models; (2) model parameters as systemic characteristic of water biocenosis; (3) method of integral transformations; (4) minimum complexity integral transformation I for an equation with Cartesian coordinates; (5) integral transformations of complete smoothing for equation with Cartesian coordinates and for equations in general curvilinear orthogonal coordinates; (6) determination of variable and of dependent parameters; and (7) parameter determination with inadequate information available. (See also W79-06166) (Bell Graf-Cornell)
W79-06177

OPTIMAL DESIGN AND OPERATION OF MULTI-RESERVOIR SYSTEMS: VOLUME I: EXPLICITLY STOCHASTIC MODELS,
Johns Hopkins Univ., Baltimore, MD.
M. H. Houck, and J. L. Cohon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 017, Price codes: A10 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Report No SAE-PDM-76-01, June 1976. 187 p, 20 fig, 19 tab, 41 ref, append.

Descriptors: *Reservoir design, *Reservoir operation, *Model studies, *Optimization, *Linear programming, *Stochastic processes, *Decision making, Benefit maximization, Screening model, Water resources development, *River basins, Planning, Multiple-purpose reservoirs, Algorithms, Equations, Operations research.

Optimization models offer a valuable tool to the river basin planner. This report is the result of research in water resources multi-methodology. To solve the complex problems of simultaneous design and operation of reservoirs, much work has been accomplished in the joint use of optimization and simulation models, where the optimization model is used as a screening tool to identify a range of alternatives worthy of more detailed analyses to be carried out by the simulation model. The phase of this research reported herein concentrates on the derivation of an improved screening model, working with ReVelle's Linear Decision Rule (LDR) and Louck's Sequential Explicit Stochastic Linear Programming (SESLP) models. These two models are restructured and extended. A reformation of the SESLP models results in a substantial reduction in computational burden so that the models are now usable for realistic systems. The LDR model is extended to explicitly include economic benefits or losses. Energy generation is also considered for the first time in the LDR model and a new perspective on the water supply potential of a reservoir system is given. (See also W79-06186) (Bell Graf-Cornell)
W79-06185

OPTIMAL DESIGN AND OPERATION OF MULTI-RESERVOIR SYSTEMS: VOLUME II, ALTERNATIVE OPTIMIZATION MODELS OF THE LEHIGH RIVER BASIN,
Johns Hopkins Univ., Baltimore, MD.
M. H. Houck, and J. L. Cohon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 018, Price codes: A08 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Report No SAE-PDM-76-02, June 1976. 144 p, 46 fig, 48 ref.

Descriptors: *Reservoir design, *Reservoir operation, *Model studies, *Optimization, *Linear programming, *Stochastic processes, *Streamflow, *Simulation analysis, *Screening model, *Dynamic programming, *Chance-constrained programming, Lehigh River basin, Planning, Water policy, Water resources development, Costs, Water storage, Economics, Systems analysis.

This report is the result of research in water resources multi-model methodology. To solve the complex problems of simultaneous design and operation of reservoirs, much work has been accomplished in the joint use of optimization and simulation models, where the optimization model is used as a screening model to identify a range of alternatives worthy of more detailed analyses to be carried out by the simulation model. One phase of this research concentrated on the derivation of an improved screening model, emphasizing ReVelle's linear decision rule and Louck's stochastic linear programming model. The other major research task--the subject of this Volume II--was to develop an additional model for multi-model approaches to river basin planning, a policy model used for deriving optimal operating policies for the system developed by the screening model. The result would be a 'three-model' methodology, where the design from the screening model and the operating rules from the policy model would be fed into the simulation model for further analyses. This volume reports on the testing of various combinations of previously developed reservoir system models in order to identify reasonable methodologies. The models considered include: a mean year deterministic linear program, a multi-year deterministic linear program, a chance-constrained linear program, the sequential explicit stochastic linear program (Loucks), and a deterministic dynamic program. Each of these models was formulated, programmed, and solved for the Lehigh River Basin which presented rich data sources. The chance-constrained programming model using linear decision rule was found to be superior on the basis of all relevant criteria. (See also W79-06185) (Bell Graf-Cornell)
W79-06186

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

GEOTHERMAL RESERVOIR SIMULATION 1. MATHEMATICAL MODELS FOR LIQUID- AND VAPOR-DOMINATED HYDROTHERMAL SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Faust, and J. W. Mercer.
Water Resources Research, Vol 15, No 1, p 23-30, February 1979. 4 fig, 25 ref.

Descriptors: *Geothermal studies, *Model studies, *Hydrothermal studies, *Mathematical models, *Thermal water, Porous media, Pressure, Enthalpy, Thermodynamics, Energy transfer, Steam, Hydrogeology, Equations.

Two alternative mathematical models are presented that are suitable for numerical simulation of geothermal reservoirs. The general mathematical model describes the three-dimensional flow of single-component water (both one and two phase) and the transport of heat in porous media. It is composed of two nonlinear partial differential equations, posed in terms of fluid pressure and enthalpy, and appropriate boundary conditions. An alternative quasi-three-dimensional model is derived by partial integration (in the vertical dimension) of the three-dimensional equations. The reservoir is assumed to have good vertical communication so that vertical equilibrium (gravity segregation) between steam and water is achieved. The resulting equations, posed in terms of vertically averaged pressure and enthalpy, include effects of an inclined, variable-thickness reservoir and mass and energy leakage to confining beds. (See also W79-06304) (Woodard-USGS)
W79-06303

GEOTHERMAL RESERVOIR SIMULATION 2. NUMERICAL SOLUTION TECHNIQUES FOR LIQUID- AND VAPOR-DOMINATED HYDROTHERMAL SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Faust, and J. W. Mercer.
Water Resources Research, Vol 15, No 1, p 31-46, February 1979. 13 fig, 4 tab, 44 ref.

Descriptors: *Geothermal studies, *Model studies, *Numerical analysis, *Hydrothermal studies, *Simulation analysis, Porous media, Vapor pressure, Enthalpy, Thermodynamics, Energy transfer, Hydrogeology, Equations, Evaluation.

Two numerical models are introduced for simulating three-dimensional, two-phase fluid flow and heat transport in geothermal reservoirs. The first model is based on a three-dimensional formulation of the governing equations for geothermal reservoirs. Since the resulting two partial differential equations, posed in terms of fluid pressure and enthalpy, are highly nonlinear and inhomogeneous, they require numerical solution. The three-dimensional numerical model uses finite difference approximations, with fully implicit Newton-Raphson treatment of nonlinear terms and a block (vertical slice) successive iterative technique for matrix solution. Newton-Raphson treatment of nonlinear terms permits the use of large time steps, while the robust iterative matrix method reduces computer execution time and storage for large three-dimensional problems. An alternative model is derived by partial integration (in the vertical dimension) of the three-dimensional equations. This second model explicitly assumes vertical equilibrium (gravity segregation) between steam and water and can be applied to reservoirs with good vertical communication. The resulting equations are posed in terms of depth-averaged pressure and enthalpy and are solved by a two-dimensional finite difference model that uses a stable sequential solution technique, direct matrix methods, and Newton-Raphson iteration on accumulation and source terms. (See also W79-06303) (Woodard-USGS)
W79-06304

SIMULATION OF STREAMFLOW OF ROCK RIVER AT LAKE KOSHKONONG, WISCONSIN, TO DETERMINE EFFECTS OF WITHDRAWAL OF POWERPLANT-COOLING WATER,
Geological Survey, Madison, WI. Water Resources Div.
W. R. Krug.
Geological Survey open-file report 79-253, January 1979. 21 p, 8 fig, 1 plate, 4 tab, 5 ref.

Descriptors: *Routing, *Streamflow, *Computer models, *Lakes, *Low flow, Consumptive use, Analytical techniques, Simulation analysis, Flow control, Nuclear powerplants, Diffusion, Thermal water, Cooling, *Wisconsin, *Rock River, *Lake Koshkonong.

A flow-routing model was used to simulate 44 years of stage data from Lake Koshkonong, Wis., and streamflow data from the Rock River downstream from the lake. The simulation was repeated for five possible degrees of consumptive use, ranging from zero to an annual average of 40 cubic feet per second. A minimum release rule was applied to the simulated operation of the dam at Indianford to guarantee at least the 7-day, 10-year low-flow discharge in the Rock River downstream from Lake Koshkonong. The simulated stage of Lake Koshkonong with consumptive use at 40 cubic feet per second was as much as 0.42 feet lower than the simulated stage with zero consumptive use for the same period. Duration of drawdown below the regulatory minimum stage of 11.8 feet, occurring

once in 10 years, increased from 83 to 132 days as consumptive use increased from 0 to 40 cubic feet per second. (Woodard-USGS)
W79-06315

FIELD VERIFICATION OF A ONE-DIMENSIONAL MATHEMATICAL MODEL FOR TRANSIENT COMPACTION AND EXPANSION OF A CONFINED AQUIFER SYSTEM,
Geological Survey, Sacramento, CA. Water Resources Div.
D. C. Helm.
In: ASCE Proceedings of the Specialty Conference on Verification of Mathematical and Physical Models in Hydraulic Engineering, College Park, Maryland, August 9-11, 1978, p 189-196, 1978. 6 fig, 2 tab, 9 ref.

Descriptors: *Land subsidence, *Pumping, *Groundwater, *Drawdown, *Computer models, Forecasting, Compaction, Water levels, Aquifer characteristics, Compressibility, Hydraulic conductivity, Hydrogeology, Permeability, Mathematical models, Aquifers, Confined water, Physical properties, Soil mechanics, Storage coefficient, Pressure, Simulation analysis, Evaluation.

Land subsidence due to ground-water withdrawal from a confined aquifer system is an expression at land surface of the net compaction at depth of the compressible layers within the system. Water-level fluctuations within coarse-grained aquifers produce boundary-stress changes on slow-draining compressible interbeds. A one-dimensional model has been applied to various field conditions ranging from a short-term test where 0.00048 meters of recoverable compaction (and subsequent expansion) of an overlying confining bed were measured during a 4-week aquifer test (including drawdown and recovery) to a long-term test where nearly 4 meters of subsidence occurred during 50 years of pumping overdraft. The model computes not only transient compaction and expansion at a site of interest but also the transient vertical distribution of preconsolidation pressure. This calculated stress distribution is used to estimate a critical depth to water needed either to initiate or to stop nonrecoverable compaction. Drawing on 15 sets of field data of stress and compaction, 15 sets of model values for average hydraulic conductivity and nonrecoverable compressibility are tabulated. Based on these estimated parameter values, future nonrecoverable compaction is predicted at each site for specified stress changes. (Woodard-USGS)
W79-06316

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
Report May 1975. 227 p, 4 fig, 12 tab, 4 append, 7 attach.

Descriptors: *Resources development, Exploration, Production, *Outer Continental Shelf, *Oil and gas, Mid-Atlantic Bight, Southern California Bight, Gulf of Alaska, Leasing.

This study examines present practices and considers several alternative procedures by which exploration may be carried out prior to leasing and examines the advantages, disadvantages and uncertainties of each. The alternatives include three ranges of exploration effort--limited, intermediate, and full--by either government exploration teams or contracting industry teams through licensing procedures. The study keys on three of the twelve 'frontier' OCS areas as representative: the Mid-Atlantic (Baltimore Canyon), Gulf of Alaska, and Southern California. It appears feasible to separate exploration from production for the major prospects identified in the frontier areas in a limited or intermediate exploration program as defined in the report. However, since full exploration would require information obtained in the process of development and production of a region, it is probably not feasible or practical to conduct full exploration prior to production. Furthermore, OTA found that an intermediate program would merely be an extension of a limited program. Consequently, if separate exploration was desired, it could be initiated on a limited basis with the decision to extend to an intermediate level deferred. The analysis also found that, as certain benefits accrue from such a separation, it is likely that there will also be certain disadvantages or uncertainties of success, time loss and other impacts accruing from separation. These should be considered by policymakers in their deliberations. It should be noted further that there are possible alternatives to separation which could resolve, in part, the issues which raise the question of whether exploration should be separated from production. (Sinha-OEIS)
W79-06473

6B. Evaluation Process

HYDRONOMIC ANALYSIS: A METHOD FOR REGIONAL ANALYSIS OF ECONOMIC AND WATER RESOURCES RELATIONSHIPS,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
A. P. O'Hayre.
Journal of Environmental Management, Vol 7, No 2, p 125-146, September 1978. 7 fig, 2 tab, 36 ref. OWRT A-033-MINN(2). 14-34-0001-7050.

Descriptors: *Hydrodynamics, *Regional analysis, *Economics, *Water resources, *Input-output analysis, *Water quality, *Effects, *Simulation analysis, *Lakes, Eutrophication, Environmental control, Monte Carlo method, Land use, Forest management, Water pollution, Systems analysis, Equations, Mathematical models, Nonpoint source pollution, Spatial variation, Timber harvest, Pulp wood harvest, Itasca County(Minn).

Previous efforts to predict regional economic and environmental relationships have proposed the use of discharged residuals as environmental criteria. Others have attempted to use models to relate discharged residuals to environmental quality parameters, but these models fail to represent the spatial dimension of pollution discharge, especially regarding non-point sources of pollution. This study was an attempt to develop a more realistic simulation of regional economic and environmental quality relationships by modeling the regional distribution of lake water quality resulting from the spatial distribution of pollutants from non-point as well as point sources. An input-output economic model of Itasca County, Minnesota was modified so that the spatial variation in pollutants discharged in association with economic activity in the region could be assessed. A regional indicator of lake water quality was developed from the distribution of lake trophic state. Monte Carlo simulation was used to derive the distribution of trophic state from the distribution of lake characteristics, land use activities and point source discharge of nutrients. The lake water quality model was calibrated for Itasca County, using sub-regions within the county. The method was used to determine the effect of forest management alternatives on economic conditions and lake water quality in the region. The results suggest that expansion of timber harvest has a minimal effect on lake water quality as long as all the increased pulp wood harvest is exported from the region. (Bell Graf-Cornell)
W79-06001

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
H. S. Hundal, R. B. Trattner, and P. N. Cheremisinoff.
Water and Sewage Works, Vol 126, No 3, p 78-80, March, 1979. 1 fig, 3 ref.

Descriptors: *Potable water, *Surface water, *Ground water, Water sources, Water quality, Water treatment, Rivers, Lakes, Impoundments, Water harvesting, Aquifers, Water wells, Safe yield, Pumping, Artificial recharge, Springs, Infiltration galleries.

Various types of surface and subsurface sources of potable water are discussed in terms of their quality and treatment requirements. The quality of river water depends on the quantity of waste discharged by upstream sources, and the volume flow of the river. Lakes and ponds generally have better, more uniform quality than rivers. An impoundment reservoir is an ideal source of potable water, requiring a minimum amount of treatment. Water harvesting uses catchment basins to collect runoff from precipitation and stores it in tanks designed to prevent seepage and evaporation losses. Groundwater is an important source, constituting about 97 percent of all freshwater. Minimal or no treatment is required and availability is relatively unaffected by droughts. An aquifer stores and transmits ground water in porous strata. If the pumping rate of a well penetrating an aquifer exceeds the recharge rate, the safe yield of the aquifer may be exceeded. In such cases, artificial recharge should be used. Springs water is usually free from bacteria or other harmful substances. Springs, like water wells, are of two types, gravity and artesians. The yields of gravity springs may be increased by constructing deep galleries across the direction of flow. (Purdin-NWWA)
W79-06008

WATER WELL MARKETS IN 1979,
E. A. Scott, Jr.
Ground Water Age, Vol. 13, No. 5, p 20, 27, 28, January, 1979.

Descriptors: *Economic prediction, *Water wells, Industrial production, Drilling, Marketing.

An economic forecast for key water well markets in 1979 is presented. Due to the cost of mortgage money, there will be a slight decline in new residential work, but to a far less extent than in similar periods in the past. Much of the slack caused by a decline in new residential jobs will be taken up by an expansion of the nonresidential market. This is due to an increase in the physical volume of commercial buildings and a trend toward the greater use of ground water in such construction. Water systems replacements will continue to grow during 1979. However, the rate at which pump replacements are growing may be slowing down due to more reliable equipment such as submersibles. New markets for the water well industry, most notably the ground-water source heat pump, will see further development in 1979. 1979 should be a banner year for the water well industry. (Purdin-NWWA)
W79-06017

DRILLERS AND INDUSTRY LEADERS LOOK AT 1979.
Ground Water Age, Vol. 13, No. 5, p 17-21, January, 1976. 1 tab.

Descriptors: *Economic prediction, *Surveys, *Drilling, Water wells.

The results of a survey of the economic outlook of 300 water well drilling contractors are presented in tabular and narrative form. The fourteen economic indices surveyed were: inflation, unemployment, gross income, net income, essential capital expenditures, discretionary capital expenditures, total expenses, administrative expenses, payroll expenses, total personnel, sales area personnel, technical personnel, and promotion. The opinions on the fourteen indices were in three categories: up over 1978, down from 1978, and little or no change. The contractors also gave verbatim reasons for their economic views. The most representative of these statements are presented for each of the fourteen indices. The overall opinion is that 1979 will be a good year for the water well drilling industry in spite of higher inflation and unemployment. (Purdin-NWWA)
W79-06018

IF YOU KNOW THE WEATHER YOU CAN PREDICT THE YIELD,
Clemson Univ., SC. Dept. of Horticulture.
For primary bibliographic entry see Field 2I.
W79-06035

ECONOMIC ASSESSMENT OF FGD SLUDGE DISPOSAL ALTERNATIVES,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5E.
W79-06041

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

AN ANNOTATED BIBLIOGRAPHY ON RIVER RECREATION.
North Central Forest Experiment Station, St. Paul, MN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 689, Price codes: A04 in paper copy, A01 in microfiche. General Technical Report No NC-41, 1978. Compiled by Anderson, D. H., Leatherberry, E. C., and Lime, D. W. 64 p.

Descriptors: *Recreation, *Rivers, *Wild River Act, *Water resources development, *Bibliographies, Abstracts, Publications, Water sports, Access routes, Natural resources, Social aspects, Social impact, Wild rivers, Campsites, Recreational demand, Recreation facilities, Scenery, Tourism, Economics.

A compilation of available reference materials consisting of more than 300 listings which document various aspects of river recreation is presented. The bibliography is organized in nine parts; in each part the papers are arranged alphabetically according to author. All references are numbered since many references are cited in more than one part. The annotation of a reference appears in the first appropriate citation and subsequent citations are referenced by number at the beginning of all other relevant sections. Part 1 covers material pertinent to water resource management and research; Part 2 includes references on the role of river resources in outdoor recreation; Part 3 presents methods to inventory and classify river recreation resources; Part 4 cites economic methods to evaluate alternative uses of river resources; Part 5 presents articles describing investigations of the impacts people and recreational activity have on river resources; Part 6 focuses on how and by whom the river is used; Part 7 cites management of river resources; Part 8 contains an unannotated listing of all Federal legislation pertaining to the National Wild and Scenic Rivers Act of 1968; and Part 9 is an unannotated listing of selected guidebooks on rivers of North America. An author index is provided at the end of the bibliography. (Davison-IPA)
W79-06099

GEOGRAPHIC-ECONOMIC ASPECTS OF POLLUTION CONTROL SYSTEMS,
Ohio State Univ., Columbus. Dept. of Geography.
C. ZumBrunnen.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 155-174 (Discussion p 175-179), September 1978. EPA-600/9-78-024. 4 fig, 21 ref.

Descriptors: *Water pollution control, *Geographic-economic aspects, *Territorial size, *Jurisdictional scale, *Water management(Applied), Optimization, Political aspects, Legal aspects, Cost-benefit analysis, Rivers, Lakes, Regions, Evaluation, Cost minimization, Marginal costs, Spatial impact.

This paper examines four considerations (questions) involved with water pollution. The first deals with the geographic-economic distribution or equity problems arising from either water pollution-generating activities or water pollution control problems; an attempt is made to apply benefit-cost concepts within a spatial context. The second section considers the issue of whether the mere territorial size or jurisdictional scale of a pollution control system enhances or impedes progress in achieving its abatement objectives. In other words, what are the inherent pros and cons associated with pollution control regions at various geographical scales. Investigated are the utility and disutility of the various scales of two types of water quality control regions, namely, political-administrative jurisdictions and natural regions such as river and lake basins. The third section briefly evaluates four broad strategies for water resource management: (a) moral suasion; (b) bargaining; (c) government regulation; and (d) economic inducments. Both of the last two water pollution control strategies are predicated upon governmental legislative action, but the latter is presumed to involve more decentralized decision making. Finally, current U.S. pollution control policies are reviewed. The paper addresses itself to legal, territorial, and economic strategies. Two implicit assumptions are: (1) the true price or value of pure water may be greater than both the U.S. and the USSR have assumed; and (2) the objective of any pollution control system should be to minimize the total costs of residual disposal which is achieved by equating the marginal costs of abatement and the marginal costs of pollution damages. (See also W79-06166) (Bell-Graf--Cornell)
W79-06172

THE RESPONSES OF THE LEGAL SYSTEM TO TECHNOLOGICAL INNOVATION IN AQUACULTURE: A COMPARATIVE STUDY OF MARICULTURE LEGISLATION IN CALIFORNIA, FLORIDA AND MAINE,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 6E.
W79-06300

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 6E.
W79-06351

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE USE OF EFFLUENT FEES TO REGULATE PUBLIC SECTOR SOURCES OF POLLUTION,
Princeton Univ., NJ. Dept. of Economics.
W. E. Oates, and D. L. Strassmann.
Journal of Environmental Economics and Management, Vol. 5, No. 3, p 283-291, September 1978. 2 fig, 14 ref.

Descriptors: *Economics, *Pollution taxes(Charges), *Regulation, *Public sector, *Pollution abatement, *Institutional constraints, Institutions, Bureaucracy, Federal government, Treatment plants, Municipal wastes, Powerplants, Weapons production, Costs, Optimization, Motivation, Incentives, Decision making, Financing, Budgeting, Policy, Niskanen model, Water pollution sources, Water pollution control, Effluents, Air pollution, Sewage disposal, Pollutants.

Pollution charges might induce public agencies to control and even reduce the amount of pollutants they introduce to the environment. Even though public agencies are organized on a non-profit basis and effluent charges assume profit-maximizing behavior by polluters, the nature of the budgeting/appropriations process in a bureaucracy makes this a feasible alternative. The analysis employs extended versions of the Niskanen model of bureaucratic behavior to determine the likely response of bureaucrats to effluent fees. Imposition of an effluent fee on a public agency can result in various outcomes: (1) the agency can request and receive a budgetary supplement from the legislature to cover the tax bill, and the pollution level will be unchanged; (2) the agency may be refused the supplement since it is presumably already receiving its maximum allocation, and it will be forced to reduce its level of pollution to meet costs; or (3) the agency may be granted the supplement but still have an incentive to shift less-polluting technology in order to increase prerequisites. This last possibility may be nullified, however, if there is a propensity to avoid the effort and complications of adopting new technology. All evidence shows public agencies to be major sources of pollution, including sewage, sulfur from power plants, and disposal of weapons production by-products. (Lynch-Wisconsin)
W79-06038

LOCATIONAL PRICING OF AN ENVIRONMENTAL INPUT,
Kansas Univ., Lawrence. Dept. of Economics.
K. Unger.
Journal of Environmental Economics, and Management, Vol. 5, No. 3, p 207-219, September 1978. 15 ref.

Descriptors: *Economics, *Effluents, *Water pollution sources, *Pricing, *Mathematical models, *Spatial distribution, Input-output analysis, Model studies, Rivers, Water quality standards, Industrial wastes, Municipal wastes, Policy, Externalities, Sites.

A model describes joint production of outputs and heterogeneous effluents for firms located along a river. Most analyses of externalities associated with joint use of an environmental input have been in spaceless economies in which all production and consumption are assumed to occur at a single site, and water quality, benefits, and costs are measured. That approach obscures the spatial nature of the supply of some environmental inputs. The location-specific pollution model is a water quality study for a fixed and finite number of firms or municipalities along a river. This study considers effluents heterogeneous, unlike most other models which reduce all effluents to biochemical oxygen demand. In the present analysis location-specific water quality standards are derived which reflect that upstream discharges impact strongly on downstream water users. Depending on the type of sequential firm interdependence, a water control agency may or may not be able to insure efficient input choices by decentralizing these choices to the firms. Under certain conditions, site-specific prices can be derived to reflect the socially imputed value of a particular type of effluent released at a given site. If each firm is assigned responsibility for cumulative water quality just below its drain pipe, then water quality control may be modelled as an application of nonsymmetrical recursive decision-making. (Lynch-Wisconsin)
W79-06039

SOME COMPLICATIONS IN THE MEASUREMENT OF ENVIRONMENTAL CONTROL IMPACTS: A CASE STUDY OF WATER POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
For primary bibliographic entry see Field 6E.
W79-06042

SOUTHEAST CONFERENCE ON LEGAL AND ADMINISTRATIVE SYSTEMS FOR WATER ALLOCATION AND MANAGEMENT, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, APRIL 19-20, 1978.
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 6E.
W79-06051

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

THE MICROECONOMICS OF WATER SUPPLY AND DEMAND IN THE NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. Dept. of Economics.
T. McHugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 642, Price codes: A08 in paper copy, A01 in microfiche. Doctor of Philosophy dissertation, March 1979, 164 p, 8 fig, 16 tab, 59 ref, 4 append. OWRT C-3119 (No. 3688)(2), 14-31-0001-3688.

Descriptors: *Water supply, *Water demand, *Operating costs, Water rates, Model studies, *Pricing policy.

The main purpose was to develop a model of the essential operating characteristics of a water utility in the Northeastern United States. Past studies of the industry have tended to look at either the demand or the supply side--but not both. The 'model' utility was statistically estimated first by estimating demand and cost functions independently of one another and alternatively as a set of simultaneous equations. Data for the estimation process was provided by personal visits to each of the sample water suppliers and conducting in-depth interviews as part of a larger project involving all aspects of water supply and demand in the Northeast. The initial demand and cost functions obtained through independent estimating techniques (Ordinary Least Squares) lent credence to the simultaneous equation model in which the quantity purchased by residential customers, utility operating costs, and water price are viewed as being determined jointly within the system. The equations are then utilized to examine the effects of a change in pricing policy by the 'model' water suppliers on utility costs and revenues. (Sink-Penn State)
W79-06111

6D. Water Demand

GROUND-WATER CONDITIONS IN THE NAVAJO SANDSTONE IN THE CENTRAL VIRGIN RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. M. Cordova.
Utah Department of Natural Resources Technical Publication No. 61, 1978. 66 p, 15 fig, 3 plates, 8 tab, 15 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Well data, *Water yield, *Water quality, Pumping, Drawdown, Groundwater recharge, Hydrogeology, Water level fluctuations, Surface-groundwater relationships, Groundwater availability, Water supply, Water demand, Chemical analysis, Utah, *Virgin River basin, Navajo Sandstone.

The central Virgin River basin, Utah, includes about 1,000 square miles in the drainage basin of the Virgin River downstream from the Hurricane Cliffs. the Navajo Sandstone of Late Traiassic and Jurassic age crops out in 234 miles of the basin and underlies younger rocks in about 450 square miles of the basin. Interpretation of data were confined to the area of outcrop of the Navajo. Lithologically the formation is essentially a quartzose sandstone, about 2,000 feet in maximum thickness. Recharge to the Navajo Sandstone is estimated for 1974 to be a minimum of 17,000 acre-feet. Movement of ground water is generally from the Pine Valley Mountains, Bull Valley Mountains, and the area east of the Hurricane Cliffs toward the Virgin River and its tributaries. The overall direction of ground-water movement is independent of the strike or plunge of the large structural features. Discharge of ground water in 1974 amounted to a minimum of 19,000 acre-feet. The average effective porosity in the saturated zone is estimated to be 17 percent. The hydraulic conductivity has an average value of 2.1 feet per day based on laboratory analysis and 5 feet per day based on field tests. The maximum amount of water in storage available to wells is estimated to be 2.8 million acre-feet. Chemical analysis of the water in storage indicates that the concentration of dissolved solids range from 103 to 1,360 mg/L. (Woodard-USGS)
W79-06310

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 6E.
W79-06351

6E. Water Law and Institutions

CALIFORNIA GROUNDWATER REPORT: IT'S FINALLY IN,
P. Call.
Pacific Ground Water Digest, Vol 2, No 3, p 17-19, March, 1979.

Descriptors: *Water law, *Water rights, *Legal review, Groundwater mining, Overdrafts, Water management(Applied), Water wells, Storage, Groundwater recharge, Judicial decisions, Legislation, Law enforcement, California.

The first comprehensive review of California water rights law since 1912 was completed by a commission consisting of university professors, water rights attorneys and former state legislators. The commission recommended a comprehensive groundwater management program enforced by state or local agencies. Overdrafts in some basins should be remedied by natural or artificial recharge and reducing the number of new wells drilled. The commission recommended clarification and streamlining of the groundwater adjudication process. The most controversial area of proposed legislation is the groundwater management section, due to enforcing powers which will be given to local managing districts. If passed, these new laws will have some effect on every area of California but especially on unregulated areas with overdraft problems. (Purdin-NWWA)
W79-06002

SOME COMPLICATIONS IN THE MEASUREMENT OF ENVIRONMENTAL CONTROL IMPACTS: A CASE STUDY OF WATER POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
R. A. Leone.
Socio-Economic Planning Sciences, Vol 12, No 3, p 103-111, 1978. 5 fig, 5 tab, 5 ref.

Descriptors: *Water pollution control, *Regulation, *Industrial production, *Costs, *Economic impact, *Alternative planning, Theoretical analysis, Economics, Measurement, Industries, Governments, Pollution abatement, Alternative costs, Prices, Policy, Textiles, Pulp and paper industry, Oil industry, Metal finishing industry, Technology, Welfare(Economics), Discount rates, Management.

The impact on industry of environmental control regulations is defined as: (1) production cost changes induced by a policy action (primary impacts), and (2) competitive and distributional consequences of those cost changes (secondary impacts). Several complications arise in measuring primary impacts, including: (1) intertemporal and spatial variations in factor prices, (2) the discounting procedure cannot by itself account for future technological options, (3) managements may respond to regulations by reorganizing their operations, and (4) changes in processes or product mix. This paper focuses on water pollution control, but the discussion applies to almost any externally-induced and dicontinuous change in factor costs. Some problems addressed are: estimation of industry cost curves, economic criteria for identifying technical alternatives to be included in engineering studies of regulatory impact, choice of minimum cost abatement methods, sensitivity of findings to factor price changes, managerial criteria for selection of control methods, intra-industry disaggregation of impacts, and dynamic economic process of adjustment to controls. Methods demonstrated are microanalytical; examples include the textile, pulp and paper, petroleum refining, and metal finishing industries. Social questions regarding regulation effectiveness are not examined. Future costs incurred by industry from regulation will probably be lower than at present because of technical change and factor substitution. (Lynch-Wisconsin)
W79-06042

LEGAL ASPECTS OF FLOOD PLAIN MANAGEMENT,
North Carolina Univ. at Chapel Hill. Inst. of Government.
W. A. Campbell, and M. S. Heath, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 639, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Report No. 137, February 1979, 49 p. OWRT B-109-NC(1). 14-34-0001-8104.

Descriptors: *Flood plain management, Floodway, Droughts, Flood insurance, Flood protection, Land use, Legal aspects.

The federal flood insurance program has made it possible for landowners in flood hazard areas to obtain subsidized insurance protection against flood damages. As a condition of this protection, however, the local governments in which flood-prone land is located must adopt various restrictions on the use of land in the floodway and flood hazard areas. The North Carolina legislative center piece for authorizing local flood plain regulations is the Floodway Act. This act is deficient both in terminology and in scope of coverage when examined in the light of the federal requirements. To remedy these deficiencies it is recommended that the Act's coverage be broadened to include flood hazard areas beyond the floodway, to include areas of coastal flooding, and to delete the uses permitted as of right in the floodway. It is important for the state to play a major coordination and advisory role in land use regulation for flood protection. Local governments need technical assistance in preparing and administering the necessary regulatory measures, and the state has an important role to play in coordinating local efforts with the Federal Insurance Administrator and in generally overseeing the program. In addition, state property must meet the federal requirements in order for the state to obtain insurance or to qualify as a self insurer. Statutory changes are suggested to meet these needs. (Kiger-North Carolina)
W79-06049

SOUTHEAST CONFERENCE ON LEGAL AND ADMINISTRATIVE SYSTEMS FOR WATER ALLOCATION AND MANAGEMENT, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, APRIL 19-20, 1978.
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 646, Price codes: A04 in paper copy, A01 in microfiche. Summary Report, Vol 1, No 1, 1978. 66 p. OWRT B-123-NC(1) and B-125-NC(1). 14-34-0001-9144, 14-34-0001-8134.

Descriptors: Water law, Water rights, Water administration, Water allocation, Land use, Interbasin transfer.

Conference objectives were: (1) to identify present and anticipated water allocation, use, and management problems in the Southeast as related to the present riparian reasonable use doctrine, (2) to analyze the adequacy of existing water law and administrative systems to cope with these problems, (3) to establish commonality of problems for sharing experiences and for identifying promising new legal and administrative approaches and research needs, and (4) to develop a responsive re-

gional action program. Water law and administration problems in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia are discussed. Individual state summaries, conclusions, and recommendations are included. An overall regional summary includes recommendations for: a restudy of existing legal and administrative systems; clarification of water rights associated with non-riparian diversion and interbasin transfer; codification and recodification of state water law; improved state law and policies with respect to minimum streamflows, water shortages, hydrologic relationships between surface and groundwater, and land use relationships.
W79-06051

RURAL WATER AND SEWER SYSTEMS PROBLEMS, NEEDS, ISSUES, OPPORTUNITIES, AND GOALS,
National Rural Water Association, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 986, Price codes: A03 in paper copy, A01 in microfiche. Report No. EDA-065, August 1976. Proceedings, First National Organizational Conference of the National Rural Water Association, Oklahoma City, OK, April 15-16, 1976, 46 p.

Descriptors: *Water supply, *Water supply development, *Sewerage, *Financing, Sewage treatment, Legal aspects, Water pollution, Water treatment, Rural areas, Community development, Area redevelopment, Investment, Government finance, Maintenance, Management, Operation and maintenance, Technology.

The goals, problems and issues of rural water systems are set forth as defined by representatives of eight State Rural Water Associations, the organization meeting in Oklahoma City. The problems and issues of rural water supply and sewage systems are broadly categorized as financial, legal and jurisdictional, technological, operational and administrative, and educational and informational. The discussion includes analyses of the financial, jurisdictional and legal aspects, and system design, management, operation and maintenance. It is concluded that the socioeconomic and intergovernmental implications of both existing systems and demands for additional systems must be addressed, and that substantial public and private investments will be required during the next few years to meet the water and sewer needs in the rural areas and small towns of America. (Davison-IPA)
W79-06102

LAND AND WATER RESOURCES CONSERVATION ACT OF 1977,
Hearings, Subcommittee on Conservation and Credit, Committee on Agriculture, U.S. House of Representatives, on H. R. 75, March 1, 1977, Serial No. 95-U, 44 p.

Descriptors: *Conservation, *Land management, *Water conservation, *Legislation, Land resources, Land use, Water demand, Water management(Applied), Water pollution, Water quality, Water resources, Water policy.

This hearing before the U.S. House of Representatives Subcommittee on Conservation and Credit of the House Committee on Agriculture addresses the Land and Water Resources Conservation Act of 1977. In order to further the conservation of land, water, and related resources this act states the congressional policy that the conduct of programs administered by the Secretary of Agriculture for this purpose should be responsive to the long-term needs of the nation. This policy is to be implemented by: (1) appraising on a continuing basis the land, water and related resources of the nation; (2) developing and updating periodically a program for furthering the conservation, protection and enhancement of the land, water and related resources of the nation; and (3) providing to Congress and the public, through continuing reports, the information developed pursuant to paragraphs (1) and (2) as stated above, and by providing Congress with an annual evaluation report. Appearing before the subcommittee were representatives of: the Sierra Club; the National Association of Conservation Districts; the Soil Conservation Society of America; and the National Wildlife Federation. All verbatim testimony is included. (Goldberg-Florida)
W79-06293

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ORGANIC ACT.
Hearings, Committee on Commerce, Science, and Transportation, U.S. Senate, on S. 2224, April 6, 1978, Serial No. 95-88, 81 p.

Descriptors: *Oceans, *Legislation, *Planning, *Priorities, Atmosphere, Political aspects, Coastal engineering, Coasts, Water resources development, Water policy, Environmental effects.

The hearing before the United States Senate Committee on Commerce, Science, and Transportation addressed Senate Bill 2224. The purpose of this bill is to establish a national ocean policy and to set forth the missions of the National Oceanic and Atmospheric Administration (NOAA). The bill designates the NOAA as the lead civilian agency with responsibility for coordinating and carrying out national ocean policy in order to improve the understanding, assessment, development, utilization, conservation and protection of ocean and coastal resources and the atmosphere. The bill states the Congressional policy that the federal government utilizes its capabilities to create and maintain conditions under which ocean, coastal, and atmospheric resources may be utilized without harming the environment so as to fulfill the needs of present and future generations. Also contemplated is the efficient dissemination of atmospheric and oceanographic research and technology to the states, local governments and the private sectors as well as other federal agencies. All testimony received by the committee is reproduced verbatim. (Goldberg-Florida)
W79-06294

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
L. D. Wood, and J. R. Hell, Jr.
Coastal Zone Management Journal, Vol. 4, p 371-404, 1978.

Descriptors: *Wetlands, *Regulation, *Land development, *Engineering, Permits, Dredging, Marshes, Swamps, Coasts, Estuaries, Judicial decisions, Planning.

Until recently, people ascribed little value to marshy lands that could not be farmed or otherwise developed. However, modern science has demonstrated the great importance of wetlands, in both environmental and economic terms. These valuable functions are discussed briefly. The U.S. Army Corps of Engineers administers the only nationwide regulatory program that controls development activities in United States waters and wetlands. The program regulates the issuance of permits to private parties for activities involving wetlands property. The statutory authorities, jurisdictional limitations, and evolution of the current corps regulations, which express a strong policy to protect wetlands, estuaries, and tidal waters from unnecessary dredging, filling, or other alterations are examined. The organization and procedures of the Corps of Engineers are explained and several important permit cases which have developed and implemented the Corps' wetlands policy are also detailed. Current and potential policies underlying the Corps' regulatory efforts are evaluated. The author concludes that the wisest policy for now is to permit alteration of wetlands only when that is clearly necessary to attain public benefits which cannot be attained otherwise. (Horwich-Florida)
W79-06295

INTERGOVERNMENTAL COMPLEXITY AND COASTAL ZONE MANAGEMENT,
New York Univ., NY. Graduate School of Public Administration.
R. L. Sparrow.
Coastal Zone Management Journal, Vol. 4, No. 4, p 363-70, 1978.

Descriptors: *Governmental interrelations, *Coasts, *Planning, *Political aspects, Management, Government finance, Shore protection, Federal jurisdiction, State governments, Local governments, Federal government, Priorities.

The primary purpose of the Coastal Zone Management Act of 1972 (CZMA) and its substantial amendments of 1976, is to initiate coastal zone management practices by means of stimulating state and local activity. Political scientists and political decision-makers have long recognized the difficulty in a federal system of determining the most appropriate jurisdictional level for a given policy activity. The CZMA, straddles the fence regarding the centralization-decentralization jurisdictional dispute. The consequence of this pattern of dispersal of authority will be relative inattention to long-term considerations, such as conservation and preservation. The potential for conflict over the use of the coastal zone is increasing. The basic difficulty is that the law itself is inconsistent in providing for the promotion of goals which are esentially conflicting. Since the problems that engender conflict in this area will not diminish in coming decades, and since the disputants include governmental as well as private forces, the likelihood exists for greater federal involvement whenever the level of conflict exceeds the bounds of existing, decentralized procedures. (Fortin-Florida)
W79-06296

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

COMPLYING WITH THE FLOOD DISASTER PROTECTION ACT,
Pennsylvania State Univ., State College.
B. L. Myers, and J. K. Ruben.
Real Estate Law Journal, Vol. 7, No. 2, p 114-131, 1978.

Descriptors: *Flood plains, *Flood plain zoning, *Flood plain insurance, *Local governments, Legislation, Flood control, Federal government, Regulation, Construction, Land use, Land development.

The most significant aspect of the National Flood Insurance Program contained in the Flood Disaster Protection Act of 1973 (Act) is that, if stringent land use controls are not enacted by local or state governments for flood-prone areas, no flood insurance will be made available to residents of such communities. In addition, no money for property acquisition, construction, or development from federal agencies will be made available in the designated 100-year flood plain. In order for individuals to benefit from this program their community must first become an 'eligible community' by complying with federal Housing and Urban Development codes and ordinances. Though no overt sanctions were included in the program, the lack of availability of flood insurance, as well as the withholding of certain federal funds, were expected to encourage compliance with the Act. Amendments are currently being considered which would mean effectively imposed sanctions on those individuals who do not comply with the Act while elminating sanctions against those where are in compliance. (Goldberg-Florida)
W79-06299

THE RESPONSES OF THE LEGAL SYSTEM TO TECHNOLOGICAL INNOVATION IN AQUACULTURE: A COMPARATIVE STUDY OF MARICULTURE LEGISLATION IN CALIFORNIA, FLORIDA AND MAINE,
Massachusetts Inst. of Tech., Cambridge.
S. Owen.
Coastal Zone Management Journal, Vol. 4, No. 3, p 269-94, 1978.

Descriptors: *Aquaculture, *Legislation, *Leases, *Technology, Marine animals, Marine plants, Coasts, Cultivation, Competing uses, Florida, California, Maine.

Aquaculture has been defined as the culture or husbandry of aquatic animals or plants for commercial purposes or to augment natural stocks. Salt-water aquaculture (mariculture) legislation in most states restricts the leasing of coastal waters for specific, existing technologies. Legal responses to innovations has been cautious and piecemeal. But legislation in California, Florida, and Maine represents a more flexible approach to accommodating new technologies. These states' legislation is broadly drafted, and provides for the leasing of coastal areas and use of the vertical water column for any type of aquaculture activity. While this represents a policy decision which would appear to encourage future innovation, the author examines the implications of such a policy and warns that there are a number of complex issues to be resolved in order for states to achieve the desired results. The failure of these states to respond fully to these issues may inhibit aquaculture innovation or unduly restrict nonaquaculture uses of the coastal zone. For example, the effects of minimum time periods or maximum tract sizes of leases are discussed, as are legislative drafting problems and rights of conflicting interest groups. (Horwich-Florida)
W79-06300

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
D. P. Hanselmann, and T. L. Vogel.
Coastal Zone Management Journal, Vol 4, No 3, p 329-35, 1978. 2 fig.

Descriptors: *Estuaries, *Great Lakes region, *Coastal marshes, *Ohio, Beaches, Marshes, Administrative agencies, Administrative decisions, Estuarine environment, Great Lakes, Freshwater marshes, Preservation.

Although much of Ohio's Lake Erie shoreline is highly developed, one section is a relatively undisturbed representative of freshwater estuaries found around the Great Lakes. This section is located at the mouth of Old Woman Creek in Erie County. In 1975, the Ohio Department of Natural Resources (ODNR) applied to the federal Office of Coastal Zone Management (OCZM) for an estuarine sanctuary grant. The purpose of such a sanctuary is to ensure the long-term protection of a freshwater estuary for the study of both the natural relationships within the ecosystem and of human impact, and for public education programs that emphasize the value of estuaries. The proposed 637-acre sanctuary is comprised of four general landscape types: marshland, woodlands, open fields, and a barrier beach. Development of sound management plants is essential to the long-term scientific/interpretational use and protection of the proposed estuarine sanctuary. The agency submitting the grant application should realize: the need to involve all affected and interested parties at an early planning stage; that the grant process may be a lengthy one; and that compromises and plan modifications may be necessary in boundaries and management plans. (Fortin-Florida)
W79-06301

THE EXCLUSIVE ECONOMIC ZONE AS A CONCEPT IN INTERNATIONAL LAW,
J. C. Phillips.
International & Comparative Law Quarterly, Vol. 26, No. 3, p 585-618, July, 1977.

Descriptors: *United Nations, *Conferences, *International waters, *International law, Oceans, Economics, Fish conservation, Shore protection, Environmental control, Continental shelf, Boundaries(Surfaces), Beds under water.

The Third United Nations Conference on the Law of the Sea was characterized by the failure of the international community to agree on any precise legal regime for the oceans. One of the suggestions that was regarded as likely to form a basis of agreement was the concept of the exclusive economic zone. An exclusive economic zone has been defined as an area beyond and adjacent to the territorial sea in which a State has sovereign rights for the purpose of exploring, exploiting, conserving and managing the natural resources, whether renewable or non-renewable, of the bed, subsoil and superadjacent waters. The sovereign rights of the coastal state pertain only to the resources of the zone rather than the zone itself. Problems that attend such a concept are: (1) the difficulty of delimiting the zone between adjacent states; (2) whether small islands should be entitled to an economic zone of their own; and (3) whether the jurisdiction of coastal states is far too extensive in regard to control over fishing resources as to control over which countries may fish in its economic zone. (Goldberg-Florida)
W79-06302

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 813, Price codes: A07 in paper copy, A01 in microfiche. Report August 1977. 124 p, 6 fig, 52 tab, 4 append.

Descriptors: *Economic impact, *Water quality standards, *Organic compounds, *Water quality control, *Analytical techniques, Cost analysis, Costs, Water treatment, Human population, Treatment facilities, Regulation, Monitoring.

An analysis considered the economic impacts of reducing the maximum contaminant level (MCL) of trihalomethanes in potable water to 0.10 mg/liter at treatment plants serving 75,000 people. The regulation proposed would also require plants serving 10,000-75,000 people. The regulation proposed would also require plantsserving 10,000-75,000 people to monitor trihalomethane levels. The analytic structure identifies regulatory criteria, the number of community water systems affected by the regulation, the available treatment alternatives, and a profile of systems' response to MCL regulation. Cost analyses of the regulation include national cost estimtes, costs to typical systems, and monitoring costs. Variables considered in the economic analysis include varying the mix of treatments which systems would select, varying the MCL, and including system size boundaries above and below the 75,000 population mark. The impacts on the industries supplying granular activated carbon, regeneration furnaces, chlorine dioxide, ozonators, and ammonia for treatment of water under the proposed regulation are also considered. Appendices provide methodology and modelling procedures, water quality data, treatment costs and sensitivity analysis, and regulatory compliance strategies. (Lisk-FIRL)
W79-06351

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

FINAL EIS GREENSBORO-GUILFORD COUNTY, N.C. 201 WASTEWATER TREATMENT SYSTEM PROJECT NO. C37037601.
Environmental Protection Agency, Atlanta, GA. Region IV.
For primary bibliographic entry see Field 5D.
W79-06345

7. RESOURCES DATA

7A. Network Design

GREAT LAKES RESEARCH ADVISORY BOARD ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
For primary bibliographic entry see Field 5G.
W79-06125

THE IMPACT OF COMPOSITE SAMPLING AND OTHER DATA AGGREGATION PROCEDURES ON POLLUTION DETECTION IN THE PULP AND PAPER INDUSTRY,
British Columbia Univ., Vancouver.
H. D. Drechsler, and P. N. Nemetz.
Canadian Journal of Forest Research, Vol. 8, No. 3, p 328-340, September, 1978. 9 fig, 11 ref, 45 tab.

Descriptors: *Pulp and paper industry, *Water pollution, *Sampling, Water pollution sources, Canada, Foreign countries, Monitoring, Data collections, Effluents, Discharge(Water), British Columbia(Canada).

The inadequacy of current procedures for the measurement and analysis of effluent data are demonstrated. The deficiencies of these procedures are illustrated using as an example the British Columbia pulp and paper industry. Four factors have been identified which restrict the ability of various monitoring systems to detect the presence and severity of excessive effluent discharges. These factors are the significant information losses associated with current grab and composite sampling techniques, the units of measurement presently required for the assessment of effluent quality, the infrequency of compliance monitoring, and information losses associated with statistical aggregation procedures used in the compilation and analysis of effluent data. (Witt-IPC)
W79-06141

CLIMATOLOGICAL ESTIMATES OF LAKE EVAPORATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
For primary bibliographic entry see Field 2D.
W79-06261

7B. Data Acquisition

TV INSPECTION LOCATES LIBYAN WATER WELL PROBLEMS,
Underground Surveys Corp., Fresno, CA.
R. DeLenikos.
Irrigation Journal, Vol 29, No 1, p 31, January-February, 1979.

Descriptors: *Water wells, *Inspection, Irrigation, Equipment, Well screens, Sands, Separators, Pumps, Telemetry, Rehabilitation, Downhole cameras.

Over 200 irrigation wells serving a large agricultural area in Libya were quickly and accurately inspected with a down-hole television system specially prepared for desert transport. The television survey revealed that most of the performations were plugged with mud while the remaining perforations were causing high entrance velocities and forcing in the sand. An eight inch stainless steel well screen with a sixteen inch production casing was installed and a separator was installed on the pump discharge to reduce the sand content. (Purdin-NWWA)
W79-06004

NEW LIFE FOR TERMINAL WELLS,
For primary bibliographic entry see Field 8A.
W79-06005

MEASURING FLUMES OF SIMPLIFIED CONSTRUCTION,

Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and A. J. Clemmens.
Paper No. 78-2506, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, IL. 13 p. 10 fig, 3 tab, 15 ref. ASAE, St. Joseph, Michigan.

Descriptors: Flumes, Measurement, Mathematical models, Flow measurement, Irrigation canals, Critical flow, Construction costs.

Mathematical modeling was applied to optimize error control and construction simplicity for the selection of a family of long-throated flumes, resembling broad-crested weirs with a sloping approach ramp, for use in trapezoidal irrigation canals. Alternate shapes and sizes were proposed for unlined canals with extensions to sizes and shapes for limited application to watershed work. (Skogerboe-Colorado State)
W79-06028

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2F.
W79-06064

HF SURFACE-CURRENT MAPPING RADAR 1977 ALASKAN OPERATIONS--LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
D. E. Barrick.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 1-20, October 1978. 14 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Mapping, *Circulation, *Ocean currents, *Radar, *Baseline studies, Oil spills, Water pollution effects, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Oil transport, Cook Inlet.

The objectives of the initial Alaskan experiments in the summer of 1977 were: (1) to demonstrate the feasibility and utility of a transportable HF radar system for operational near-real-time mapping of surface currents in remote coastal areas, and (2) to gather environmental baseline data on surface circulation around Kachemak Bay in the Lower Cook Inlet. By presenting sample radar-produced current maps at two opposing periods in the tidal cycle and comparing these data with drifter buoy velocity measurements, the credibility of the claim is established that such systems can play a major role in future coastal current-data gathering studies. Results show that: (1) a single current-vector map covering thousands of square kilometers can be produced after 15 minutes operation; (2) at least three orders of magnitude more data can be gathered in a given twelve-hour period than by any alternative technique; (3) the system rms error is at worst one-half knot (current velocity), and most likely considerably better. (Sinha-OEIS)
W79-06187

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
A. E. Belon.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 260-291, October 1978. 10 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Monitoring, *Remote-sensing, *Sea ice, *Oil spills, *Geomorphology, Offshore platforms, Baseline studies, Hazards, Environmental effects, Meteorology, Forecasting, Alaska, *Outer Continental Shelf, Petroleum development, Petroleum transport.

The acquisition of remote-sensing data, especially satellite data, has proved to be a cost-effective method of monitoring the environment on a synoptic scale. Meteorological satellites have been used for over a decade to study weather patterns and as an aid to weather forecasting. The morphology and dynamics of sea-ice which are relevant to navigation and construction of offshore structures, the patterns of sediment transport and sea-surface circulation which will aid to forecast trajectories of potential oil spills and impact on fisheries, the nature of ecosystems in the near-shore regions which can be changed by human activity, are among the critical development-related environmental parameters which can be studied, in conjunction with appropriate field measurements, and eventually routinely monitored by remote-sensing. (Sinha-OEIS)
W79-06200

DEVELOPMENT AND OPERATION OF A REMOTE SENSING DATA ACQUISITION PLATFORM FOR OCS STUDIES,
Naval Arctic Research Lab., Barrow, AK.
M. Frank, and G. A. Laursen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 835-852, October 1978. 4 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Remote sensing, *Radar, *Aircraft, *Oil spills, *Mapping, Sea ice, Baseline studies, Environmental effects, Path of pollutants, Resources development, Water pollution, Alaska, *Outer Continental Shelf, *Oil transport, Side looking airborne radar(SLAR), North Slope(AK), Petroleum development.

The primary objective of the proposed program is to establish, operate and maintain a remote sensing data acquisition system using primarily side looking airborne radar (SLAR), a precision radiation thermometer (PRT-5) and aerial photomapping cameras. The SLAR has been installed into the dedicated NARL aircraft C117-D in a modular configuration. SLAR imagery is easily obtained through most weather conditions. It becomes a potentially important tool for determining the magnitude of an oil spill under sea ice. It can then be used to map the movements of oil slicks as they are moved by currents and winds. The precision radiation thermometer (PRT-5), or remote thermometer, measures the effective emission-surface temperature using broad spectrum infrared. Pointedly, ground, snow surface, water, oil slick and oil seep temperatures can be determined quickly and with a high degree of accuracy. (Sinha-OEIS)
W79-06209

EFFECTS OF CHANNEL DAMS ON DISSOLVED OXYGEN CONCENTRATIONS IN NORTHERN ILLINOIS STREAMS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5G.
W79-06234

INTERPRETATION OF WELL LOGS IN A CARBONATE AQUIFER,
Geological Survey, Denver, CO. Water Resources Div.
L. M. MacCary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 508, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-88, July 1978. 30 p, 12 fig, 4 tab, 10 ref.

Descriptors: *Logging(Recording), *Borehole geophysics, *Electrical well logging, *Radioactive well logging, Aquifers, Carbonates, Analytical techniques, Aquifer characteristics, Evaluation, Texas, *Edwards aquifer, Well log analysis, Cross plot methods, M and N plots, Pattern recognition methods.

Geophysical logs from two core holes in the Edwards aquifer in Texas were analyzed and the results compared to other geologic and hydrologic data obtained from well tests and core studies. The acoustic velocity, sidewall neutron, and density logs are especially useful in the study of carbonate aquifers because porosity, secondary porosity, rock composition, and bulk density can be determined from them. Under some conditions, deeply focused resistivity logs can be used to calculate formation water resistivity and the cementation exponent. The log analysis methods described can be applied to other carbonate systems by hand plotting and a few simple calculations which can be performed on a pocket calculator. The hydrologist is advised of specific criteria which his logs must meet in order to derive maximum value from the analysis. (Woodard-USGS)
W79-06312

THE EFFECT OF LIQUID WASTE DISCHARGES FROM STEAM GENERATING FACILITIES,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-06357

ODOR ASSESSMENT FOR SEWAGE SLUDGE SAMPLES 300A01002,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5D.
W79-06364

FLOW MEASUREMENT USING A CONDUCTIVITY FLOW METER--INITIAL INVESTIGATION,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
P. H. John, F. A. Johnson, and P. Sutcliffe.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 16-30, 1978. 7 fig, 2 tab, 13 ref.

Descriptors: *Flow, *Flowmeters, *Flow measurement, *Instrumentation, Current meters, Channel flow, Streamflow, Closed conduit flow, Laboratory tests, Tracers, Salts, Sodium compounds, Electrical conductance, Measurement, Velocity, Hydrology, *Conductivity flowmeters.

The limitations of existing salt velocity flow measurement techniques were reviewed, and the use of a new automatic method called the Conductivity Flow Meter was described. During trials in a laboratory flume, the variables associated with the new system were examined to assess their effect on performance, and a series of tests was carried out to investigate the precision and accuracy of the meter. The results showed the Conductivity Flow Meter to compare favorably with other salt-velocity techniques and current meters and indicated that it could find wide application in flow measurement both in closed conduits and open channels. (Sims-ISWS)
W79-06419

A PRINTING COUNTER FOR THE FIELD RECORDING OF EVENTS,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Chemistry Div.
J. E. Patterson.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 31-38, 1978. 7 fig, 6 ref.

Descriptors: *Logging(Recording), *Equipment, *Instrumentation, On-site investigations, Hydrologic data, Meteorological data, On-site data collections, Solar radiation, Soil moisture, Temperature, Rainfall, Winds, Flow, Electronic equipment, Printing counters, Recorders.

A novel, low-cost housing for a single-channel Swiss printing counter mechanism allows recording of some hydrological and meteorological variables under a variety of field conditions. A range of accessories has been developed for recording solar

radiation, soil moisture, and average temperatures. Variables such as rainfall, wind run, water flow, etc., may be recorded by using the appropriate transducer. (Sims-ISWS)
W79-06420

7C. Evaluation, Processing and Publication

NUMERICAL MODELLING OF AN AQUIFER SYSTEM WITH INTERMITTENT RECHARGE,
James Cook Univ., North Queensland (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W79-06020

WATER RESOURCES DATA FOR LOUISIANA, WATER YAR 1978--VOLUME 1. CENTRAL AND NORTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 412, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-1, December 1978. 412 p, 9 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Central and northern Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; state only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06305

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1978--VOLUME 2. SOUTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 534, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-2, January 1979. 365 p, 13 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Southern Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; stage only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06306

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1978--VOLUME 3. COASTAL LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 535, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-3, January 1979. 326 p, 5 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Coastal Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; stage only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06307

HYDROLOGIC MONITORING IN THE AREA OF THE TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI-ALABAMA, FISCAL YEAR 1978,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-06311

HYDROLOGIC, GEOLOGIC, AND WATER-QUALITY DATA, OCHLOCKONEE RIVER BASIN AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. A. Pascale, J. R. Wagner, and J. E. Sohm.
Geological Survey Water-Resources Investigations 78-97 (open-file report), August 1978. 515 p, 4 fig, 15 tab, 18 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Data collections, Gaging stations, Rain gages, Water wells, Aquifer characteristics, Hydrogeology, Well data, Water yield, Water levels, Water analysis, Chemical analysis, Florida, *Ochlockonee River basin.

This report presents hydrologic, geologic, and water-quality data collected within the Ochlockonee River basin area, in the panhandle of northwest Florida. The data are presented in graphs and tables. Surface-water data include streamflow measurements and analyses of water collected at 58 sites; ground-water data include descriptions of 360 wells and core holes, analyses of water and hydrographs of selected wells, lithologic logs of 131 wells and test borings, and natural-gamma logs of selected wells ranging in depth from 110 to 1,346 feet. Rainfall and municipal pumpage data also are compiled. Maps show the location of the data-collection sites. (Woodard-USGS)
W79-06318

ARSENIC, NITRATE, IRON, AND HARDNESS IN GROUND WATER, FAIRBANKS AREA, ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-06320

LOW-FLOW FREQUENCY OF MINNESOTA STREAMS,
Geological Survey, St. Paul, MN. Water Resources Div.
S. A. Warne.
Geological Survey Water-Resources Investigations 78-132 (open-file report), 1978. 1 sheet, 4 fig, 5 ref.

Descriptors: *Low flow, *Frequency analysis, *Streamflow, *Maps, *Minnesota, Base flow, Gaging stations, Flow characteristics.

Flow-frequency data for Minnesota streams are presented in atlas form for 161 gaging stations and about 300 partial-record stations for 7-day low flows with 2- and 10-year recurrence intervals. The report also discusses the factors that influence low flow and shows that the magnitude of low flows generally increases from west to east in Minnesota. (Woodard-USGS)
W79-06321

WATER AVAILABILITY, CLEBURNE COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
R. V. Chandler, and G. C. Lines.
Alabama Geological Survey Map 143, 1978. 29 p, 9 fig, 4 tab, 21 ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, Hydrologic budget, Water supply, Maps, Streamflow, Flow rates, Water storage, Lakes, Reservoirs, Aquifers, Water yield, Groundwater availability, Water wells, Hydrogeology, Water analysis, Chemical analysis, *Alabama, *Cleburne County(Ala).

In Cleburne County, Alabama, large quantities of surface water are available from the Tallapoosa and Little Tallapoosa Rivers. The Tallapoosa River near Heflin has an average flow of about 410 Mgal/d (million gallons per day). The Little Tallapoosa River has an average flow of about 300 Mgal/d where it enters the county. Surface water stored in lakes and farm ponds in the county is estimated to be 2,000 million gallons. The principal sources of ground water in the county are saprolite and fractured bedrock. Some wells in the vicinities of Heflin and Chulafinnee may yield 100 gal/min (gallons per minute) or more, but wells in other parts of the county generally yield 25 gal/min or less. Although large quantities of ground water are not available from individual wells, water sufficient for domestic and stock needs generally can be obtained. Water supplies adequate for small towns and light industries can be obtained from wells. Both surface water and ground water generally are of good chemical quality and suitable for most uses. Surface water is soft and low in dissolved-solids content. Ground water is generally soft and low in iron content; however, locally it ranges from moderately hard to very hard and contains more than 0.3 milligram per liter of iron. Total water use in the county in 1969 was about 1.6 Mgal/d, which is less than 1 percent of the water available. (Woodard-USGS)

9-06322

ENGINEERING WORKS

.. Structures

INSPECTION LOCATES LIBYAN WATER LL PROBLEMS,
derground Surveys Corp., Fresno, CA.
r primary bibliographic entry see Field 7B.
9-06004

W LIFE FOR TERMINAL WELLS,
T. Guardino.
ific Groundwater Digest, Vol 2, No 2, p 19-23, ruary, 1979.

scriptors: *Water wells, *Repairing, *Maintece, Equipment, Inspection, Hydraulic equipnt, Rupturing, Well screens, Clogging, Pumping s, Rehabilitation.

ing construction costs, limited availability of ll sites, and environmental protection are three sons for increased interest in water well maintece and rehabilitation. Rehabilitation involves air and/or redevelopment based on information ained from visual inspection with a television . Essential information includes structural con-ion, corrosion, encrustation, screen location, and ation of reducers. The hydraulic sewage or ming tool is used to repair ruptures and overlapg perforations. Clogged screen and perforations be cleaned with a variety of techniques. Each ll should be carefully analyzed prior to employ- any method. Well maintenance includes the ll itself and the pumping unit. The amount and e of maintenance are dependent on the quality the water. Regular treatment of wells which ve encrustation problems will ensure continuous iciency and prolong the well and pump life pectancy. A maintenance program should be termined with pumping tests to establish both mp and well performance, and water quality alyses. Water well drilling contractors would fit most by subcontracting with well maintece and rehabilitation specialists. (Purdin-WWA)
79-06005

ME SIMPLE SAND SOLUTIONS,
tional Water Well Association Worthington, H.
E. Gass.
ater Well Journal, Vol. 33, No. 3, p 36-37, rch, 1979.

escriptors: *Sand pumping, *Well filters, Well reens, Pipes, Water wells, Well development, ell rehabilitation, Clogging, Erosion.

scharging of sand from wells penetrating layers fine sand causes clogging of pipes and sprinkler igation lines. Coarse grained particles may mage screens and reduce well efficiencies. Sand ssing through the pump erodes pump bowls and pellers, drastically shortening their performance e. Causes of sand pumping include: (1) improper lection of a slot size for the well intake; (2) calized enlargement of slot or screen openings, holes in the casing due to corrosion or abrasion; a broken or defective seal or packer; (4) settling d bridging of the gravel pack, which exposes rts of the natural formation; (5) inadequate well velopment; and (6) decomposition of borehole alls in uncased wells in sandstone aquifers. Solu-ons to the above problems are recommended aring in mind that some cases of sand pumping ay require more complex remedies. Improved sign, construction and well development techques will significantly reduce the incidence of nd problems. Many sandpumping wells can be habilitated to produce clear, sand-free water. urdin-NWWA)
79-06012

LAMINATED WOOD FOR CASING OR SCREEN.
Canadian Water Well, Vol. 5, No. 1, p 18, February, 1979.

Descriptors: *Well casings, *Well screens, *Wood, Well construction, Cost.

A wood laminate, SBF-Obo, with high mechanical strength has been used successfully in deep wells in Europe and Africa. Well screens can be easily made with horizontal saw cuts in the casing with little loss in crushing strength. The cost is the same as steel casing but the light weight, 4 lb/ft for 6 inch casing and 25 lb/ft for 24 inch, gives added benefits in handling and storage. (Purdin-NWWA)
W79-06014

HERE'S HOW LINERS SAVED TWO PROBLEM WELLS,
Universal Oil Products, Inc., Saint Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8C.
W79-06019

ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL: APPENDICES,
American Public Works Association, Chicago, IL.
R. H. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 052, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/2-77-017b, December 1977. 145 p, 2 fig. 803151.

Descriptors: *Sewers, *Economics, *Publications, *Infiltration, *Abstracts, *Documentation, Information retrieval, Pipes, Design criteria, Cities, Construction materials, Manholes, Maintenance, Repairing, Rehabilitation Gates.

An adjunct is presented to a study conducted to identify and analyze the current practices for determining and controlling infiltration and inflow (I/I) and to investigate the role of roots and tide or backwater gates in the I/I problem. Literature abstracts concerning sewer infiltration studies, sewer design, flow measurement, new pipe material, pipe maintenance and repair, and pipe testing are presented in Appendix A. Appendix B contains the survey of the root control program questionnaire and includes the interviewers reports from Los Angeles, Los Angeles County, Sacramento, Denver, Austin, Dallas, Fort Worth, North Little Rock, St. Louis, Buffalo, Madison, Milwaukee and other cities. Appendix C contains the tide gate survey questionnaire and responses. (Davison-IPA)
W79-06100

COLLAPSE PRESSURE PREDICTION FOR THERMOPLASTIC WATER WELL CASINGS,
Auburn Univ., AL. Dept. of Civil Engineering.
D. York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 665, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 1978, 107 p, 14 fig, 3 tab, 39 ref, append. OWRT A-059-ALA(1).

Descriptors: *Well casings, Plastics, Water wells.

This study analytically determined the collapse resistance of thermoplastic water well casings subjected to a linearly varying external pressure. The method used in the analysis was the principle of minimum potential energy, energy of the external loads, and the strain energy of the confining medium surrounding the casing. The collapse pressure prediction equation was developed in terms of casing geometry, external loading conditions, casing material properties, and surrounding soil or grout support. Parametric studies were conducted to evaluate the influence of these parameters on the predicted collapse pressure. Results indicate that the current method used in designing thermoplastic water well casings in some cases underestimates the collapse resistance of the casing.
W79-06108

THE BOTTOMLESS DAM,
Monash Univ., Clayton (Australia).
R. M. Phatarfod.
Journal of Hydrology, Vol. 40, No. 3/4, p337-363, February 1979. 6 tab, 26 ref.

Descriptors: *Dams, *Dam design, *Model studies, Mathematical models, Analytical techniques, Inflow, Storage, Reservoir storage, Discharge(Water), Reservoirs, Reservoir releases, Mathematics, Equations, Markov processes, Boundary processes.

The purpose of the work reported was to show that it is more fruitful to consider the bottomless (infinitely deep) dam as an approximation to the finite dam rather than the topless (infinitely high) dam considered hitherto. It was shown by taking a wide variety of input models that the theory for the former is far simpler, and the final results are in a form simple enough to give a quick estimate of the size of the reservoir required. (Sims-ISWS)
W79-06263

UPLIFT PRESSURES ON HOLLOW GRAVITY DAMS,
Roorkee Univ. (India). Water Resources Development Training Centre.
A. S. Chawla, and N. Mal.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14464, p 257-273, March 1979. 7 fig, 7 ref, 3 append.

Descriptors: *Uplift pressure, *Gravity dams, *Dam design, *Model studies, Mathematical models, Numerical analysis, Dams, Concrete dams, Joints(Connections), Drainage, Seepage, Loads(Forces), Engineering, Civil engineering, *Hollow gravity dams.

Closed-form solutions were obtained with the help of the Schwartz-Christoffel transformation for the determination of uplift pressures on hollow gravity dams. The uplift pressures were calculated numerically from the derived equations and plotted to facilitate the use of the results for design purposes. It was seen that uplift pressures along the joint between two monoliths drop almost linearly from the full-uplift pressure at the upstream face of the dam to zero uplift at the head of the cavity. The uplift along the center line of the monolith drops linearly to about less than 1/3 of the differential head at a point opposite the head of the cavity. Beyond this, the reduction in the uplift pressures was gradual. (Sims-ISWS)
W79-06264

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
H. W. C. Aamot.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 956, Price codes: A04 in paper copy, A01 in microfiche. Special Report, 1976. 63 p, 54 fig.

Descriptors: Foreign countries, Islands, Public utilities, *Water distribution(Applied), Electrical networks, *Sewerage, *Waste water treatment, *Municipal wastes, Pipes, Thermal water.

Reykjavikj's utility systems including water distribution, sewage collection, heat distribution, and electric transmission, are discussed. The sewage system consists of 203 miles of concrete pipes buried 4 ft underground. The lines are laid for gravity flow with outlet into the ocean. A primary treatment system has been proposed at a cost of $10-20 million over ten years. Clean water which needs no chlorination is drawn from wells 15 km east of the city and distributed through cast iron and polyethyelene pipes. The normal maximum water usage is 65,000 cu m/day. The electrical distribution system is described, as is the geothermal district heating and hot water system. (Small-FIRL)

W79-06337

ABATEMENT OF DEPOSITION AND SCOUR IN SEWERS,
Water Resources Engineers, Inc., Walnut Creek, CA.
M. B. Sonnen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 585, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-212, 1977. 114 p, 35 fig, 13 tab, 50 ref, 1 append.

Descriptors: *Design, Sewers, *Storm drains, *Combined sewers, Solid wastes, *Mathematical models, Conduits, *Pipe flow, Waste water treatment.

A new methodology is described for analyzing the design of storm and combined sewer systems. A review is presented of feasible methods for reducing the first-flush of solids in overflows from storm and combined sewers. These include increasing conduit slopes, providing cunette sections or other pipe shapes which maintain high velocity during low flow periods, providing upstream capture of solids during high flows, and providing increased treatment downstream. A mathematical model was developed which simulates the behavior of solids in pipelines as bedload, suspended load, or washload. The model is an adaptation of the EPA Storm Water Management Model. Sample analyses are given. The model can be applied to the design of total systems while considering the physical and economic factors of parts of the total system. (Small-FIRL)
W79-06369

EVALUATION OF BACKFLOW PREVENTION DEVICES: A STATE-OF-THE-ART REPORT,
National Bureau of Standards, Washington, DC.
G. C. Sherlin, and R. W. Beausoliel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 913, Price codes: A07 in paper copy, A01 in microfiche. Final Report, 1976. 137 p, 5 fig, 20 tab, 38 ref, 1 append.

Descriptors: Potable water, Performance, *Pipe flow, Piping systems(Mechanical), *Flow control, Flow characteristics, *Standards, *Testing, *Reliability.

The state-of-the-art of backflow prevention devices was reviewed. A systematic review of the literature is presented along with reports of consultations with water purveyors, plumbing officials, laboratory officials, and field researchers. Effective devices, test methods, and laboratory practices are considered. Existing backflow prevention devices provide protection against backflow, however not enough data exists to quantitatively establish effectiveness. None of the existing devices is fool proof. A. S. S. E. Standards are the only standards that have definitive test procedures and test setups. The test methods could be improved by the use of realistic service condition simulation. Tests on the reliability of devices, functional performance tests, and development of a fail-safe indicator are recommended. (Small-FIRL)
W79-06378

8B. Hydraulics

SOLAR IRRIGATION PROGRAM - STATUS REPORT, OCTOBER 1976 THROUGH JANUARY 1977,
Sandia Lab., Albuquerque, NM.
R. L. Alvis.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-0380, Price codes: A04 in paper copy, A01 in microfiche. Report SAND-77-0380, 1977. 66 p, 43 fig, 11 ref.

Descriptors: *Irrigation, Irrigation engineering, *Costs, *Energy, Performance, *Pump testing, Deep wells, New Mexico, Arizona, *Heat transfer.

Progress made by the ERDA solar irrigation program from October 1976 through January 1977, is discussed. The program, which initially consisted of a shallow well experiment under construction in NM, has been expanded to include a deep well experiment in AZ and a follow up demonstration system. Technical discussion of the shallow well experiment is emphasized. The solar collector field, 6710 sq ft aperture area, heats a heat transfer fluid (Exxon Caloria HT 43). When the heat transfer fluid exits the collector field, it is recirculated if its temperature is below 420F. If above 420F, the fluid is sent either to the heat engine or thermal storage. The heat engine either takes heated oil from storage or from the collectors and heats its working fluid by use of a boiler and fluid pump. The working fluid is expanded through a turbine. Cost effectiveness for the solar pump was calculated as a function of the Rankine cycle engine efficiency. Minimum system cost occurs at an engine cycle efficiency between 15% and 16%. The cost of purchasing and installing a new irrigation system in the isolated Estancia Valley of NM is estimated to be $50,000. If solar collectors cost about $5/sq ft, solar would be competitive if natural gas cost $5 mcf for a system operating more than 2200 hr/yr, electricity cost $.10/kWh for a system operating 1900 hr/yr, and diesel cost $.55 gal at 2600 hr/yr. (Small-FIRL)
W79-06362

SOLAR IRRIGATION PROGRAM PLAN REVISION,
Sandia Labs., Albuquerque, NM.
R. L. Alvis, and S. C. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-770730, Price codes: A03 in paper copy, A01 in microfiche. Report SAND 77-0730, 1977. 34 p, 4 fig, 6 ref.

Descriptors: *Irrigation, Irrigation engineering, Pumps, *Pump testing, Energy, *Solar radiation, New Mexico, *Deep wells, Arizona, *Pilot plants.

The ERDA solar irrigation program plan is updated through fiscal year 1979. Construction of the experiment in the Estancia Valley, NM is planned. The system will begin operation, data will be collected, and complete performance calculations will be made. New Mexico State University will plan and design the optimum utilization of off-season energy. Studies will be performed to upgrade the system to power a low energy center pivot system. A study will be initiated to determine the potential market for solar powered irrigation. A deep well experiment will be conducted in AZ. Also, an international workshop is planned to disseminate the results of the first season of operation. (Small-FIRL)
W79-06363

EVALUATION OF BACKFLOW PREVENTION DEVICES: A STATE-OF-THE-ART REPORT,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 8A.
W79-06378

STORMWATER RUNOFF ON URBAN AREAS OF STEEP SLOPE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, V. T. Chow, and A. O. Akan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 755, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-168, 1977. 91 p, 28 fig, 10 tab, 48 ref, 3 append.

Descriptors: *Mathematical models, *Storm runoff, *Urban runoff, *Slopes, *Runoff forecasting, Hydraulic engineering, Hydraulics.

The applicability of commonly used urban storm runoff prediction models to drainage basins with steep slopes was investigated. The hydraulics of runoff on steep slope areas was reviewed, and how it differs from that of mild slope areas was discussed. Also, the difficulties in applying commonly used methods to steep slope basins were presented. It appears that engineers may not be familiar wit the problems associated with steep slope areas an may not realize that numerical results given usin conventional methods may not be reliable. A simple method for steep slopes was proposed, an an example utilizing data from the Baker Stree Drainage Basin in San Francisco, is provided (Small-FIRL)
W79-06380

8C. Hydraulic Machinery

CAUSES AND EFFECTS OF 3-PHASE POWE UNBALANCE.
Water Well Journal, Vol. 33, No. 3, p 54-5 March, 1979. 1 tab.

Descriptors: *Pumps, *Electric motors, Installa tion, Electric currents, Electrical equipment Safety, Water wells.

The problem of unbalanced electrical loads to sub mersible pump motors is discussed. A step-by-ste procedure is outlined for proper pump installation A chart is provided which matches motor KVA with motor horsepower. A simple method of cal culating the percent of current unbalance is use for three examples of motor hookups. The hooku with the lowest percentage of current unbalanc will result in maximum motor efficiency. The per centage of current unbalance should not exceed 5%. (Purdin-NWWA)
W79-06009

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
D. Bacon.
Water Well Journal, Vol. 33, No. 3, p 70, March, 1979. 1 tab.

Descriptors: *Heat pumps, *Cost comparisons, *Efficiencies, Heating, Economics, Ground water.

The Coefficient of Performance (COP) and operating cost of a demonstration ground water heat pump are compared with the air-to-air heat pump and other conventional heating systems for the months of November and December, 1978. The ground water heat pump had a COP of approximately 3.0, meaning that it produced three times more energy than it consumed. This resulted in a saving of 33% over the air-to-air heat pump for the specified months. Comparative data was accumulated for the central Ohio area. (Purdin-NWWA)
W79-06010

BASIC PERFORMANCE FACTORS OF CENTRIFUGAL PUMPS.
Water Well Journal, Vol. 33, No. 3, p 61-63. March, 1979.

Descriptors: *Centrifugal pumps, *Performance, Pressure head, Capacity, Horsepower, Curves, Pump testing, Efficiencies, Water wells.

Four factors which determine the performance of centrifugal pumps are: head or pump pressure; capacity it delivers; horsepower it requires; and efficiency. Pump head is usually given in terms of how many feet of water it can support. Total pressure is the sum of static pressure and motion pressure or velocity head. Capacity is the number of gallons per minute a pump will deliver. Centrifugal pumps depend on three types of horsepower: water, brake, and wire-to-water. Formula for the derivation of each type are given. Pump performance is shown through the use of performance curves. Head-capacity curves and horsepower curves must be determined from pump tests. A formula to calculate the pump efficiency curve is given. When pumping rpm is changed, effects can be calculated by using affinity laws which state that: pump capacity changes directly with speed; head changes with the square of the pumping rpm; and brake horsepower changes with the cube of pumping rpm. (Purdin-NWWA)
W79-06011

ERE'S HOW LINERS SAVED TWO PROB-EM WELLS,
niversal Oil Products, Inc., Saint Paul, MN. ohnson Div.
H. Muller.
acific Groundwater Digest, Vol. 1, No. 2, p 47-, February, 1979.

escriptors: *Water wells, *Liners, Well casings, ell screens, Corrosion, Sands, Clogging, Incrus-tion.

uidelines are provided for sizing liner OD, liner-sing annulus, gravel pack, and pump. Advan-ges of using continuous slot screens in liners are at extra drawdown is reduced and acidizing will ore effectively remove incrustations in areas of rd water. Two case studies of successful use of ers in saving corroded wells and eliminating nd pumping are discussed. Not every well can be ved by a liner, however. In some cases, a badly nding well will choke off the water so the sand ogs the original perforations. (Purdin-NWWA)
79-06019

D. Soil Mechanics

TILIZATION OF SEWAGE SLUDGE FOR ERRAIN STABILIZATION IN COLD RE-IONS,
rmy Terrestrial Sciences Center, Hanover, NH.
. A. Gaskin, W. Hannel, A. J. Palazo, R. E. ates, and L. E. Stanley.
vailable from the National Technical Information ervice, Springfield, VA 22161 as AD-A047 368, rice codes: A03 in paper copy, A01 in microfiche. pecial Report 77-37 November 1977. 38 p, 29 fig, 3 tab, 6 ref, append.

escriptors: *Erosion control, *Soil stabilization, Sewage sludge, *Vegetation establishment, *Nu-ients, Moisture content, Runoff, Cold regions, ew Hampshire, Waste water, Sludge disposal, unicipal wastes, Fertilizers.

ourteen test plots were established in Hanover, ew Hampshire to evaluate the effectiveness of ewage sludgeand primary effluent in the stabiliza-on of terrain in cold regions. The plots were 10 y 40 ft with individual 350 gal tanks to collect ediment and were located at an angle of 16 de-rees. Variables in 13 of the plots were: the nutri-nt source as fertilizer, sludge, or primary effluent; oisture as irrigation and nonirrigation; erosion ontrol material as jute netting, straw with tacking ompound, and no erosion material; and vegeta-on, three grasses and two legumes. The control lot lacked fertilizer, seed, and erosion control aterial. Results of the study indicated that the rosion control measures had an efficiency of 89.6-9.8%, based on a soil loss from the control plot of 4,531 lb (dry weight)/acre. Sludge was found to ct as both a nutrient source and an erosion control aterial and reduced runoff velocity and absorbed oisture. When soil loss was considered a function f the nutrient source, sludge-treated plots lost an verage of 150 lb soil/acre, fertilized plots lost 814 b/acre, and primary effluent treated plots lost 81.7 lb/acre. (Lisk-Firl)
W79-06342

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

AN ANNOTATED BIBLIOGRAPHY ON RIVER RECREATION.
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 6B.
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ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL: APPENDICES,
American Public Works Association, Chicago, IL.
For primary bibliographic entry see Field 8A.
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 14
JULY 15, 1979

W79-06501--W79-07000

ie Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the ansaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

elected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent nographs, journal articles, reports, and other publication nats. The contents of these documents cover the water-ted aspects of the life, physical, and social sciences as l as related engineering and legal aspects of the charac-stics, conservation, control, use, or management of water. ch abstract includes a full bibliographical citation and a set lescriptors or identifiers which are listed in the **Water sources Thesaurus.** Each abstract entry is classified into fields and 60 groups similar to the water resources re-arch categories established by the Committee on Water sources Research of the Federal Council for Science and chnology.

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lected Water Resources Abstracts is designed to serve scientific and technical information needs of scientists, gineers, and managers as one of several planned services the Water Resources Scientific Information Center RSIC). The Center was established by the Secretary of the erior and has been designated by the Federal Council for ience and Technology to serve the water resources com-nity by improving the communication of water-related search results. The Center is pursuing this objective by co-dinating and supplementing the existing scientific and tech-al information activities associated with active research d investigation program in water resources.

provide WRSIC with input, selected organizations with tive water resources research programs are supported as enters of competence" responsible for selecting, abstract-ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06769

2. WATER CYCLE

2A. General

UTILIZATION AND INTERPRETATION OF HYDROLOGIC DATA WITH SELECTED EXAMPLES FROM NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resource Research Center.
For primary bibliographic entry see Field 7A.
W79-06502

THE WATER BUDGET AND POTENTIAL WATER RESERVES OF THE EAST AFRICA SOURCE REGION OF THE NILE,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
E. Vowinckel, and S. Orvig.
Journal of Applied Meteorology, Vol. 18, No. 2, p 148-155, February 1979. 2 fig, 8 tab, 7 ref, 1 append.

Descriptors: *Hydrologic budget, *Africa, *Potential water supply, *Water resources, Rivers, Lakes, Watersheds(Basins), Rainfall, Precipitation(Atmospheric), Runoff, Evaporation, Swamps, Land use, Irrigation, Agriculture, Vegetation, Vegetation effects, Radiation, Solar radiation, Evapotranspiration, Model studies, Hydrology, Effects, Meteorology, Climatology, *Nile River.

An energy budget model was used, with daily synoptic surface and upper air data from 4 stations in East Africa, to calculate all terms of the surface energy balance once for each day and each night of 1973. The calculated evaporation was combined with precipitation values to give estimates of water surplus or deficit for a variety of natural regions. The surface included is the main source region of the White Nile, the study comprising the drainage area down to Nimule on the border of Sudan. The average outflow there is about 22 x 10 to the 9th power cu m/year, and the investigation attempted to estimate the effects on this outflow, and the amount of water potentially available for irrigation, by chaning certain surface parameters in the energy budget model. These surface parameters described the vegetation density, the soil types as characterized by water holding capacity, and surface slope. Lake Victoria is sufficiently large to generate its own air circulation and a precipitation maximum. Nevertheless, the lake does not enhance the regional outflow because of the high evaporation rate. The smaller lakes have substantial negative water budgets, as would be the case for all man-made reservoirs. The mountain regions contribute more than 60% of the total annual runoff from the land area. By a number of changes in the surface parameters in the model, a series of estimated values were obtained of the water potentially available for irrigation and the resulting altered outflow in the Nile at Nimule. (Sims-ISWS)
W79-06591

EQUATIONS OF VOLUME AND SALT BALANCES OF BRINE PONDS,
Moscow Highway Inst. (USSR).
N. A. Kartvelishvili, and S. S. Remizova.
Water Resources, Vol. 4, No. 6, p 935-940, November-December 1977. 3 fig, 10 ref. Translated from Vodnye Resursy, No. 6, p 168-173, November-December 1977.

Descriptors: *Brines, *Ponds, *Model studies, Mathematical models, Salts, Water balance, Salt balance, Precipitation(Atmospheric), Evaporation, Storage, Underground storage, Mathematics, Monte Carlo method, Equations, Brine ponds, Salt dilution.

In the 1950s in the USA and later in England, France, USSR, and other countries, the method of storing petroleum, petroleum products, and gas in underground storage reservoirs leached out in rock-salt deposits began to be developed. The product stored in the reservoirs is displaced by a salt solution, for the preparation and storage of which open surface brine ponds are created. For normal operation of underground reservoirs and to avoid their dissolution and collapse, the brine pond should contain a required volume of solution of a certain concentration during the entire year, regardless of the weather conditions. However, as was shown by investigations conducted on experimental industrial brine ponds and in special open storages, the solution stored under various climatic conditions in the Tadzhik, Ukrainian, and Armenian SSR, and also near the city of Valdai, during the year undergoes considerable changes both in volume and in concentration of salts as a consequence of freezing, evaporation, precipitation of salt, dilution by atmospheric precipitation, etc. In this case, the salt concentration on the surface of the brine pond varies from the initial concentration of 318 g/liter required for operation to 5-10 g/liter with considerable vertical stratification. The concentration and volume of the solution in the brine pond can be controlled by adding new portions of solution. To determine the additional volume of solution and its concentration, it is necessary to solve the equations of the volume and salt balances of the brine pond. (Sims-ISWS)
W79-06611

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. V. Kulakov, and E. I. Breslav.
Water Resources, Vol 4, No 6, p 821-827, November-December 1977. 4 fig, 1 tab, 12 ref. Translated from Vodnye Resursy, Vol 6, p 29-37, November-December 1977.

Descriptors: *Heat balance, *Water balance, *Distribution patterns, Precipitation(Atmospheric), Moisture, Evaporation, Radiation, Solar radiation, Heat, Heat transfer, Analytical techniques, *USSR.

A rather distinct regularity was observed in the territorial distribution of components of water and heat balances. This regularly is due mainly to the zonal character of the distribution of the incoming short-wave solar radiation and precipitation. The effect of other physiographic factors on the normal distribution of components of water and heat balances is comparatively small. This makes it possible to construct generalized relations for large territories between precipitation, evaporation, and maximum possible precipitation, which is determined mainly by the radiation balance. The purpose of this work was to determine these relations for the plains of the European and Asiatic territories of the USSR. (Sims-ISWS)
W79-06616

SIMULATED STREAMFLOW RESPONSE TO POSSIBLE DIFFERENCES IN TRANSPIRATION AMONG SPECIES OF HARDWOOD TREES,
Northeastern Forest Experiment Station, Durham, NH.
C. A. Federer, and D. Lash.
Water Resources Research, Vol. 14, No. 6, p 1089-1097, December, 1978. 8 fig, 4 tab, 17 ref.

Descriptors: *Streamflow, *Transpiration, Hydrologic cycle, Model studies, Simulation analysis, Hardwood, Forest watersheds, Watershed management, Evapotranspiration.

Possible differences in transpiration among species of hardwood trees were simulated in a hydrologic model, called Brook, to estimate the effects of these differences on monthly and annual streamflow. Brook is a deterministic, lumped-parameter model that simulated streamflow from small, forested watersheds in the eastern United States. The model uses only daily mean temperature and daily precipitation as input. A 4-week difference in timing of leaf-development in spring or color change in autumn caused differences of 10-60 mm in simulated annual streamflow. When daily transpiration varied by 20%, as it might with differences in leaf diffusive resistance among species, differences in simulated streamflow ranged from 15 to 120 mm annually. Differences in root distribution with depth can affect the availability of soil water; varying this availability caused differences in simulated streamflow of 15-60 mm. In all cases the smaller differences occurred when the soil was dry at the time of differing transpiration. On a deep residual soil the differences in streamflow were spread through the year, but on a shallow till soil the differences were restricted to the months in which there were changes in transpiration. Differenences in response among 15 degrees north-facing and 15 degrees south-facing slopes and a horizontal surface were minor. (Skogerboe-Colorado State)
W79-06705

RATES OF WEATHERING AND SOIL FORMATION ON GRANITE IN RHODESIA,
Science and Education Administration, Coschocton, OH.
L. B. Owens, and J. P. Watson.
Soil Science Society of America Journal, Vol. 43, No. 1, p 160-166, January-February 1979. 7 fig, 7 tab, 30 ref.

Descriptors: *Weathering, *Watersheds(Basins), *Africa, *Soil surveys, *On-site investigations, Geomorphology, Soils, Water quality, Runoff, Soil formation, Soil analysis, Geochemistry, Rocks, Analysis, Calcium, Sodium, Potassium, Magnesium, Aluminum, Silica, Cations, Streamflow, Rain water, Sands, Silts, Clays, Hydrogen ion concentration, Soil horizons, Foreign countries, Foreign research, *Rhodesia, *Rusape watershed(Rhodesia), *Juliasdale watershed(Rhodesia).

Rates of weathering and soil formation on granite were studied in two areas of Rhodesia using small watersheds. The Juliasdale watershed of 0.91 sq km is hilly and has a mean annual rainfall of 1,220 mm. The Rusape watershed of 7.33 sq km is more nearly level and has a mean annual rainfall of 920 mm. Streamflow was measured in the two catchments over a period of at least 7 years. Streamwater, rainwater, soil, and rock samples were analyzed for Ca, Mg, K, Na, Si, and Al. The rate of granite weathering was calculated using Barth's equation which links the rate of weathering to the amount of an element removed in solution per unit time, its concentration in the rock, and its concentration in the weathered product. Sodium and Ca were the elements used in the Barth equation. The weathering rates in the Juliasdale and Rusape watersheds were estimated at 400 and 150 kg/ha per year, respectively, or 15.4 and 5.8 mm/1000 years. The concepts of C. E. Marshall and J. F. Haseman as well as S. W. Buol include changes in bulk density during the weathering process and give soil formation rates more acceptable than those of Barth. Thus, the rate of soil formation was found to be 11.0 mm/1000 years in the Juliasdale watershed and 4.1 mm/1000 years in the Rusape watershed. (Humphreys-ISWS)
W79-06741

EXPERIMENTAL NUMERICAL SIMULATION OF UNSTEADY WATER FLOW IN A MULTI-BRANCH RIVER DELTA,
For primary bibliographic entry see Field 2L.
W79-06749

Group 2A—General

WATER RESOURCES OF THE POTOMAC RIVER BASIN, WEST VIRGINIA,
Geological Survey, Morgantown, WV. Water Resources Div.
For primary bibliographic entry see Field 6D.
W79-06813

THE MAKING OF DESERTS: CLIMATE, ECOLOGY, AND SOCIETY,
Toronto Univ. (Ontario).; Clark Univ., Worcester, MA.; and University Coll., London (England).
K. F. Hare, R. W. Kates, and A. Warren.
Economic Geography, Vol. 53, No. 4, p 332-346, Oct. 1977. 3 fig, 56 ref.

Descriptors: *Desertification, *Irrigation effects, *Biodegradation, *Social impact, *Environmental effects, *Balance of nature, Droughts, Ecosystems, Comprehensive planning, Social aspects, Climatology, Social function, Human resources, Climatic data, Variability, Planning, Arid lands.

The multi-faceted and intricately interwoven nature of the processes of desertification have long complicated attempts to unravel their causes from their effects. Three fundamental questions emerge in this endeavor: (1) to what degree is the inherent variability of climate, possibly coupled with climatic change and human activity, responsible for desertification, (2) can the ecological evidence for desertification be untangled from a morass of observational problems, temporal uncertainties as to trend, and ambiguities as to the areal extent of afflicted regions, and (3) what are the human dimensions, the causal mechanisms and the human impacts, of desertification. Water resource development has for long been hampered by the extreme climatic variability inherent to the arid regions and contemporary desertification is the result of this variability, including drought cycles, and the increasing pressures exerted by man upon the land and vegetation. Agricultural endeavors, both irrigated and rainfed, have frequently upset the precarious balance of nature in many of the worlds deserts, with waterlogging and increasing salinity resulting. Emphasis is placed by these authors, upon the needs to understand and cope with desertification, to minimize the ecological impact of resource use to avoid contributing to these destructive processes and to assist individuals and groups affected by desertification. Accordingly, the corrective measures offered here take many forms, but all stem from a concern for human systems as the central focus of desertifications causes and consequences. (Tickes-Arizona)
W79-06839

SUPPLYING DATA TO USERS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
W. J. Ozga.
Technical Bulletin No. 111, 1979, 21 p.

Descriptors: *Streamflow, *Water levels, *Sediments, Data storage and retrieval, Basic data collections.

This publication contains a description of the various types of streamflow, water level, and sediment data that are available and how they can be requested. (WATDOC)
W79-06853

PHYSICAL-GEOGRAPHIC AND HYDROLOGIC DESCRIPTION OF THE TEST SITE IN THE USSR (MOUNTAIN REGION OF THE SYRDAR'YA RIVER BASIN IN THE NORTHERN PART OF THE FERGANA DEPRESSION) AND DATA ON GROUND HYDROLOGIC, METEOROLOGIC, AND ACTINOMETRIC MEASUREMENTS,
Available from the National Technical Information Service, Springfield, VA 22161 as N77-18537, Price codes: A03 in paper copy, A01 in microfiche. NASA Technical Translation F-17,523, February 1977. 48 p, 9 fig, 10 tab, 7 ref. Translation by Leo Kanner Associates, Redwood City, California. NASA 2790.

Descriptors: *Drainage, *Rivers, *Streamflow, *Mountains, Soils, Watersheds(Basins), Geology, Vegetation, Snowfall, Rainfall, Precipitation(Atmospheric), Runoff, Snow, Snow cover, Snow melt, Evaporation, Discharge(Water), Hydrology, *USSR.

Mountain configuration, elevation distribution, river patterns, soil types, and irrigation systems were described for the test site (mountain region of the Syrdar'ya River basin in the northern part of the Fergana Depression). Mean-diurnal, mean-monthly, and mean-multiannual discharge data were given for the flows of the most important rivers. Springs and streams were described as to their numbers and total yield. Typical vegetation in the various soils was described by region. (Sims-ISWS)
W79-06878

SUPPORT OBSERVATIONS FOR WEATHER MODIFICATION OPERATIONS IN THE SAN JUAN MOUNTAINS AND A PROCEDURE FOR ESTIMATING SNOWPACK RUNOFF,
Western Weather Consultants, Inc., Durango, CO.
L. M. Hjermstad, and R. A. Mendenwaldt.
Final Report No. WWCI FR-003, January 1979. 46 p, 3 fig, 7 tab, 6 ref, 1 append. 7-07-83-V0005.

Descriptors: *Precipitation(Atmospheric), *Meteorology, *Weather data, *Weather modification, *Cloud seeding, *Snowpacks, *Snowmelt, Runoff, Runoff forecasting, Streamflow forecasting, Rainfall, Rainfall intensity, Rain gages, San Juan Mountains(Colorado), Environmental Data Network.

Surface precipitation measurements from the San Juan Mountains of Southwestern Colorado were obtained to expand and continue the Project Skywater data base for precipitation measurements. Field work involved the calibration, installation, weekly collection of the data, and maintenance of six recording precipitation gages. The data obtained were reduced, quality checked, and put into a computer compatible format. The usefulness of the Bureau of Reclamation's Environmental Data Network (EDN) was evaluated for cloud seeding operations. The most limiting constraint of the EDN was the availability of data at a consistent time. The programs available on the EDN were extremely valuable for evaluating weather modification potential. Wintertime precipitation and runoff relationships in the San Juan Mountains were analyzed and an equation was developed which could forecast by mid-May the runoff from the winter's snowpack to within 5% of the actual runoff observed. (Davison-IPA)
W79-06940

2B. Precipitation

SATELLITES AS AN AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W79-06505

GUIDELINES FOR FLASH FLOOD AND SMALL TRIBUTARY FLOOD PREDICTION,
National Oceanic and Atmospheric Administration, Washington, DC. Div. of Scientific Service.
L. A. Hughes, and L. L. Longsdorf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 461, Price codes: A02 in paper copy, A01 in microfiche. NOAA Technical Memorandum NWS CR-58, Revised, March 1978. 11 p, 2 fig, 2 append.

Descriptors: *Precipitation(Atmospheric), *Flood forecasting, *Flash floods, *Thunderstorms, *Radar, *Rainfall intensity, Precipitation intensity, Weather forecasting, Tributaries, Basins, Regions, Central US, Warning systems, Streamflow forecasting, Regional flood, Watersheds(Basins).

A structured step-by-step approach to determining the threat and extent of flash floods in the Central Region is presented. Heavy rain threat areas and the flash flood watch, estimating the flood and issuing the flash flood warning, the use of radar data during threatening thunderstorms, the use of radar and storm spotter reports, and determining the area of the stream basin involved in the storm are discussed. (Davison-IPA)
W79-06563

A STUDY OF RAINFALL PATTERN IN RELATION TO CROP PLANNING OVER THE HARYANA STATE,
Haryana Agricultural Univ., Hissar (India).
O. P. Bishnoi, and K. K. Saxena.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 501-507, July 1978. 7 fig, 2 tab, 1 ref.

Descriptors: *Rainfall, *Distribution patterns, *Crops, Precipitation(Atmospheric), Climates, Weather, Variability, Monsoons, Climatic zones, Climatology, Meteorology, Agriculture, *India, *Haryana State(India).

Haryana State receives a range of 200 to 1200 mm of annual rainfall in 7 agroclimatic zones. The rainfall patterns of these zones were discussed, with special reference to the amount, variation, and probabilities based on the rainfall data of the rain-recording stations. The existing cropping patterns were analyzed at block level in relation to rainfall pattern, variability, etc. (Sims-ISWS)
W79-06586

ON THE CONCENTRATION OF SULFATE IN PRECIPITATION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W79-06592

STATISTICS OF RAINFALL OVER PATHS FROM 1 TO 50 KM,
Politecnico di Milano (Italy).
G. Drufuca, and R. R. Rogers.
Atmospheric Environment, Vol. 12, No. 12, p 2333-2342, 1978. 9 fig, 8 tab, 15 ref, 2 append.

Descriptors: *Rainfall, *Statistics, *Model studies, Mathematical models, Weather data, Precipitation(Atmospheric), Storms, Distribution patterns, Spatial distribution, Rain gages, Probability, Rainfall disposition, Rainfall intensity, Weather, Meteorology, Rainfall over paths, Path length.

Ten years of data from the tipping-bucket raingage of the McGill Observatory, Montreal, were analyzed using the synthetic storm technique to generate statistics of rain along paths ranging from 1 to 50 km in length. For each rain event and for every path length considered, the mean and mean-square rain rate were calculated. These were then employed to obtain the standard deviation and the uniformity of the rain for each event and every path. Probability distributions of these quantities were compiled, and their dependence on path length was noted. The tendency for uniform structure is strong on short paths, but it decreases with increasing path length. Probability distributions of rain rate were calculated for paths of various lengths, conditioned by the path-average rate. These distributions can be used in applications in which there is a nonlinear dependence on rainfall rate, such as electromagnetic interactions with rain and the scavenging of pollutants. For paths up to 10 km in length, the modal value of rain rate was found to be equal to the path-average rate for all combinations of path length and average rate. With increasing path length, a second mode corresponding to zero rain rate or very weak rain becomes increasingly important and eventually dominant. Approximately half of the total variance of spatial fluctuations in rain rate is accounted for by scales shorter than 8 km. (Sims-ISWS)
W79-06603

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W79-06616

SOIL MOISTURE VARIATION UNDER BARE CONDITIONS AT PUNE AND DELHI IN RELATION TO RAINFALL,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2G.
W79-06750

STATISTICAL DISTRIBUTION OF DIFFERENT CUMULATIVE PERIODS OF RAINFALL IN HARYANA,
Haryana Agricultural Univ., Hissar (India).
O. P. Bishnoi, and K. K. Saxena.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 528-534, July 1978. 5 fig, 2 tab, 8 ref.

Descriptors: *Rainfall, *Distribution, *Statistics, Precipitation(Atmospheric), Distribution patterns, Curves, Frequency curves, Histograms, Equations, Probability, Agriculture, Crops, Monsoons, Meteorology, Climatology, *India, *Haryana State(India).

The statistical distribution of the accumulated rainfall for one, two, three, four, six, eight and sixteen weeks commencing from the onset of the southwest monsoon (25th standard week) was studied in respect of a low rainfall station, Hissar, and high rainfall station, Ambala in the Haryana State. The study of rainfall distribution indicated that up to a cumulative period of four weeks skewness is very high and, therefore, normal distribution cannot be fitted. In such cases gamma distribution was fitted and found satisfactory. Whereas beyond four weeks cumulative period, normal distribution was found satisfactory. Probability charts were prepared using the theoretical distribution to study their behavior with respect to crop planning. (Sims-ISWS)
W79-06752

CHARACTERISTICS OF SHORT PERIOD RAINFALL IN GUJARAT,
Meteorological Office, Poona (India).
N. N. Khambete, and B. C. Biswas.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 29, No. 3, p 521-527, July 1978. 3 fig, 4 tab, 4 ref.

Descriptors: *Rainfall, *Distribution patterns, *Variability, Temporal distribution, Spatial distribution, Precipitation(Atmospheric), Frequency, Monsoons, Crops, Agriculture, Climatology, Meteorology, *India, *Gujarat State(India), Short-period rainfall.

Weekly rainfall of 30-70 years for one station in each of 15 districts in the dry land tract of Gujarat State was studied. The assured amounts of rainfall that may be expected to be exceeded in 30 and 50% of the years were shown. The distribution of dry and wet weeks during the monsoon season was examined. In general, the number of wet weeks varied from 2 to 12 in each year during the monsoon season and the remaining were dry weeks. The average number of wet weeks increased from west to east. The mean length of a wet spell also increased from 2 weeks at Bhuj to 3 weeks at Dohad. Mean length of a dry spell in monsoon varied from 3 to 2 weeks. (Sims-ISWS)
W79-06753

MAJOR CLIMATOLOGICAL DISCONTINUITIES IN THE MONTHLY MONSOON ACTIVITY IN THE NEIGHBORHOOD OF THE WESTERN GHATS,
Institute of Tropical Meteorology, Poona (India).
D. A. Mooley.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 508-514, July 1978. 1 fig, 3 tab, 2 ref.

Descriptors: *Rainfall, *Temporal distribution, *Distribution patterns, Networks, Rain gages, Precipitation(Atmospheric), Monsoons, Climates, Variability, Mountains, Effects, Meteorology, Climatology, *India, *Western Ghats(India), Climatological discontinuities.

The major climatological discontinuities in the monsoon activity from July to August and from August to September in the neighborhood of the Western Ghats were studied in detail on the basis of a close network of raingage stations, and the role of the Western Ghats was examined. The criterion used for defining the major climatological discontinuity was based on the quartiles of the monthly rainfall distribution. The Western Ghats appear to play a differential role. Since meteorological conditions are most favorable during July and become progressively less favorable with the advance of the summer monsoon season, the Western Ghats enhance rainfall substantially under favorable conditions, and decrease the rainfall substantially under relatively unfavorable conditions, and thus contribute to the major climatological discontinuities. (Sims-ISWS)
W79-06754

THE DEVELOPMENT OF ORGANIC ICE NUCLEI GENERATORS FOR WEATHER MODIFICATION,
Denver Research Inst., CO. Cloud Physics Lab.
N. Fukuta, M. N. Plooster, J. A. Armstrong, A. Gorove, and J. R. Butz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 952, Price codes: A07 in paper copy, A01 in microfiche.
Final Report, Volume I, NSF/RA-770136, June 1977. 140 p, 37 fig, 5 tab, 68 ref, 4 append. NSF ENV73-02910.

Descriptors: *Weather modification, *South Dakota, *Cloud seeding, *Equipment, Rainfall, Cloud physics, Nucleation, Aircraft, Weather, Meteorology, Climatology, Organic ice nuclei, Generators.

The development of prototypes of ground and airborne organic smoke generators was addressed. The center of the program reported involved the development of three kinds of organic ice nuclei generators. Two supporting studies, one on the performance of supersonic nozzles to optimize the nozzle design, and the other on ice nucleation mechanisms of organic smoke particles using a new thermal diffusion chamber, were also discussed. Also, a prototype generator tested in cumulus clouds in South Dakota showed encouraging effects of seeding. (Sims-ISWS)
W79-06765

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
For primary bibliographic entry see Field 2E.
W79-06807

PREHISTORIC PALAEOECOLOGY OF THE SAHARA ATLANTIC COAST IN THE LAST 10,000 YEARS: A SYNTHESIS,
Centre Univ. de Luminy, Marseille (France). Lab. de Geologie du Quaternaire.
N. Petit-Maire.
Journal of Arid Environments, Vol 2, No 1, p 85-88, March 1979. 1 fig, 9 ref.

Descriptors: *Paleoclimatology, *Archaeology, Recent Epoch, Dating, Droughts, Quaternary period, Climatic data, Arid climates, Invertebrates, Mammals, History, Sahara, Morocco, Mauritania, Coasts, Deserts, Littoral.

Results of recent interdisciplinary studies of the remains of Quaternary prehistoric sites and Holocene human occupation along the present Atlantic coast between Morocco and Mauritania point to a decrease in aridity around 3500 BP. This synthesis of the invertebrate fauna, large mammalian fauna, palaeobotany, archaeological context, and human remains suggests a slight decrease in aridity between 3000 and 4000 BP, with sedentary life in the Sahel extension zone up to 20-21N, and semi-sedentary occupation further north. Differences in the continuity and density of sites are correlated mainly with the littoral profiles and/or with the proximity to water-holes or wells. It is speculated that prehistoric inhabitants switched from a hunting-gathering economy during faunal optimas to a predominantly seafood gathering activity during the most unfavorable arid periods. (Tickes-Arizona)
W79-06836

2C. Snow, Ice, and Frost

SATELLITES AS AN AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg.
Presented at American Society of Civil Engineers, Convention and Exposition, held in Boston, MA, on April 2-6, 1979. 23 p, 11 fig, 1 tab, 18 ref.

Descriptors: *Satellites(Artificial), *Water resources, *Remote sensing, Flood, Precipitation, Hurricanes, Snow, Ice breakup, Rivers.

The National Oceanic and Atmospheric Administration (NOAA) currently operates two different satellite systems, the NOAA polar-orbiting satellites and the GOES system of geostationary satellites. The two GOES satellites currently operational are stationed over the equator at 75W and 135W longitude, respectively. Examples of satellite data applications to water resource problems are presented to draw attention to a current source of data often overlooked by water managers. Although spatial and temporal constraints exist, satellite data can contribute useful information toward solutions of mesoscale and macroscale water resource problems; e.g., areal snow cover determinations, river ice, flood extent, and short-term precipitation estimates. Satellites are a valuable source of remotely sensed data whose potential as a water resource management tool needs to be more extensively appreciated by the engineering community and more extensively developed by the hydrologic community. (NOAA)
W79-06505

ON HEAT AND MASS FLUX THROUGH DRY SNOW,
Oslo Univ. (Norway). Dept. of Mechanics.
E. Palm, and M. Tveitereid.
Journal of Geophysical Research, Vol 84, No C2, p 745-749, February 20, 1979. 6 fig, 1 tab, 11 ref.

Descriptors: *Snow, *Heat flow, *Convection, *Mathematical models, Model studies, Analytical techniques, Analysis, Theoretical analysis, Water vapor, Thermal properties, Mass transfer, Porous media, Boundary processes, Thermal convection.

The conditions for obtaining thermal convection in dry snow were examined. It was shown that thermal convection will occur in dry snow layers with strong vertical temperature gradients and large air permeabilities (i.e., old snow). Thermal convection will lower the insulating power of the snow and increase the flux of water vapor through the snow layer. It will also lead to a pronounced decrease in snow density in the lower part of the snow layer and an increase in snow density in the upper part of the snow layer. Thermal convection may be important for the rate of formation of depth hoar. The magnitude of the heat and mass flux in convection was computed for several values of the Rayleigh number. (Humphreys-ISWS)
W79-06585

SPECTRAL DISTRIBUTION OF RADIATION IN THE NORTHERN GREAT LAKES DURING WINTER,

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W79-06596

MODELLING ICE DISSIPATION IN EASTERN LAKE ERIE,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
R. R. Rumer, Jr., and P. M. Yu.
Journal of Great Lakes Research, Vol 4, No 2, p 194-200, June 1978. 3 fig, 1 tab, 15 ref. NOAA 2-35281, 03-6-022-35236.

Descriptors: *Lake Erie, *Great Lakes, *Ice cover, *Lake ice, *Model studies, Mathematical models, Heat transfer, Iced lakes, Ice loads, Meteorological data, Climatic data, Analytical techniques, Ice, *Niagara River, Ice dissipation, Ice thickness.

A previously developed mathematical model, which considered both the heat exchange processes at the air-ice interface and the ice transport rate via the Niagara River, was used to simulate the ice dissipation process in eastern Lake Erie. The model, which assumed the ice thickness to be constant over the lake, has been further developed to take into account variable ice thickness. Buffalo meteorological data were used for the computation of the net heat exchange at the air-ice interface. Results of the model application illustrated the relative importance of in-lake ice melt to ice transport via the Niagara River during the dissipation period. Model results were found to give reasonably good agreement with the limited ice information available for the 1976 dissipation period. (Sims-ISWS)
W79-06598

TEMPERATURE FINE STRUCTURE NEAR THE SEA-ICE MARGIN OF THE CHUKCHI SEA,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06739

AN EXPERIMENTAL STUDY OF BRINE DRAINAGE AND CONVECTION IN YOUNG SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
T. M. Niedrauer, and S. Martin.
Journal of Geophysical Research, Vol. 84, No. C3, p 1176-1186, March 20, 1979. 17 fig, 1 tab, 14 ref. ONR NR 307-252, N00014-76-0234.

Descriptors: *Sea ice, *Brines, *Laboratory tests, Ice, Sea water, Ice-brine systems, Ice-water interfaces, Desalination, Equipment, Photography, Convection, Temperature, Channels, Oceanography.

In a series of experiments using a 1.6-mm-thick freezing tank, thin sections of salt water ice were grown which exhibit the same drainage features as natural sea ice. The tank design permitted photographs to be taken, while thermocouples mounted in the tank walls recorded the temperature profiles within the ice. Convection was observed in both the skeletal layer and in the brine channels by the flow of dyed brine. Flow in the skeletal layer was cusplike in appearance, consisting of narrow downflow regions separated by broad upflow regions. Above the skeletal layer, several brine channels were also usually present in the ice, and convective overturning occurred in these channels. The convection caused temperature fluctuations of 0.05 deg C, which calculations show increase the vertical heat flux by 1%. The brine drainage channels, which were usually sloped 30 deg to 60 deg to the horizontal, always had isotherms tilted from 0 deg to 13 deg in the same direction. The brine channels move both horizontally and vertically through the ice by melting their lower walls and freezing on the upper walls. An analysis based on the heat flux due to brine channel convection showed that convection can drive these wall movements. Observations suggested that most of the brine movement in the channels is caused by recirculation of water from below the ice. On a small scale, the formation of brine pockets from brine tubes also was observed. (Sims-ISWS)
W79-06757

ICE GROWTH STUDIES IN DULUTH-SUPERIOR HARBOR 1974-75,
Minnesota Univ. -Duluth.
R. T. Clapper Jr., D. Smith, K. Stortz, and M. Sydor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 170, Price codes: A04 in paper copy, A01 in microfiche. Report, September 5, 1975. 68 p, 39 fig, 3 tab, 8 ref, 2 append. NOAA 04-5-022-13..

Descriptors: *Lake ice, *Great Lakes, *Harbors, *Lake Superior, Ice, Ice loads, Ice cover, Heat budget, Physical properties, Model studies, Mathematical models, On-site investigations, Water temperature, Radiation, Solar radiation, Lakes, Navigation, *Duluth-Superior Harbors.

This study concerned the investigation of the ice growth and heat budget in the Duluth-Superior Harbor. The Harbor, located at the extreme western end of Lake Superior, is one of the major shipping ports on the Great Lakes. It is ice bound from mid December to mid April, causing cessation of interlake shipping in the winter months. Interest in the extension of winter shipping has gained lately in light of recent economical considerations for transportation of coal and oil along the Great Lakes. Initial investigations on the feasibility of winter shipping in Duluth resulted in installation of an experimental bubbler system which was devised to keep the channels open in the early winter to facilitate shipping of iron ore and movement of vessels into the Harbor for repair and modification. The limited bubbler installation in Howards Bay, 1973-74, for instance, proved to be quite successful in retarding ice growth. However, the physical principles governing the ice growth in the Harbor are complex and are not well understood. Thus, problems arising in ice growth forecasting, design, and construction of ice retarding methods, and evaluation of the environmental implications of winter shipping require a detailed investigation on the physical processes and the heat budget for the entire Harbor. (Sims-ISWS)
W79-06763

SNOW SURVEY AND VEGETATION GROWTH IN THE SWISS ALPS,
Zurich Univ. (Switzerland). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W79-06764

2D. Evaporation and Transpiration

EQUATIONS OF VOLUME AND SALT BALANCES OF BRINE PONDS,
Moscow Highway Inst. (USSR).
For primary bibliographic entry see Field 2A.
W79-06611

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W79-06616

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
A. F. Beck.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE2, Technical Note, p 411-415, April 1979. 1 fig, 2 tab, 1 ref, 1 append.

Descriptors: *Evapotranspiration, *Soil disposal fields, *Beds, *Design, Water pollution, Underwater, Drains, Drainage, Septic tanks, Soils, Temperature, Rainfall, Lodging, Urbanization, Water uses, *Septic tank effluent, Experimental ET beds, Pan evaporation, Bare soil, St. Augustine grass.

Evapotranspiration beds are used in lieu of drain fields in disposing of septic tank effluent in areas where the soil can't absorb water or where water is absorbed so rapidly that there is a possibility of contamination of underground water. Twice daily field measurements of water depth in 12 experimental ET beds were made from April 1976-March 1977 in San Antonio, Texas. In addition, measurements were also made of temperature, rainfall, and pan evaporation. It was concluded that evapotranspiration beds ranging from 777 square feet to 1,295 square feet can serve two- to four-bedroom houses. The beds should be shallow to reduce construction costs and to take advantage of high evapotranspiration rates near the ground surface. Beds should be level, and the top of the bed should be mounded to keep rainwater from ponding over the bed. A thick grass growth on the surface of the bed is desirable but not necessary. Evapotranspiration beds function on rainy days, but they can not be used where the bed surface freezes. (Roberts-ISWS)
W79-06748

NATURAL FREEZE-THAW SEWAGE SLUDGE CONDITIONING AND DEWATERING,
Rush Engineering Services Limited, Listowel, Ontario.
R. J. Rush, and A. R. Stickney.
Environmental Protection Service, Ottawa, Canada. Technology Development Report EPS 4-WP-79-1, January 1979, 40 p, 4 fig, 12 tab, 24 ref.

Descriptors: *Freeze-thaw tests, *Sewage sludge, *Dewatering, Watersheds(Basins), Sewage lagoons, Activated sludge, Aerobic treatment, Anaerobic digestion, Biochemical oxygen demand, Chemical oxygen demand.

In 1975, an experimental program was initiated at the Wastewater Technology Centre (WTC), Burlington, with the overall objective of developing an engineering design method for natural freeze-thaw sewage sludge dewatering on drainage beds. This study reports on a laboratory investigation and preliminary design for a natural freeze-thaw sewage sludge process. Four types of sewage sludge (conventional waste activated, extended aeration waste activated, aerobically digested and anaerobically digested) were frozen, thawed and drained on bench scale drainage beds. The effect of various sludge addition rates on sludge dewatering characteristics and filtrate quality was evaluated and sludge freezing rate information collected. All of the sewage sludges investigated showed a marked improvement in dewaterability after freeze-thaw. The rate of sludge application had no discernible effect on the results over the range studied. (WATDOC)
W79-06854

2E. Streamflow and Runoff

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND JUNCTION AND DRY GULCH CREEKS, DURANGO, COLORADO.
Army Engineer District, Sacramento, CA.
Prepared for The City of Durango and The Animas Regional Planning Commission, CO, May, 1977. 11 p, 10 fig, 20 plates, 4 tab.

Descriptors: *Cloudbursts, *Historic floods, *Flood data, *Animas River(CO), *Colorado, *Junction Creek(CO), *Dry Gulch Creek(CO), Floods, Flooding, Flood flow, Indirect flood measurement, Flood profiles, Storms, Flood recurrence interval, Flood stages, Peak discharge, Stage-discharge relations, Rivers, Floodways, Flood plains, Channels, Durango(CO), 100-year flood, 500-year flood.

This report details flood hazard information for a 9 mile study reach of the Animas River, as well as for Junction Creek (4 mi) and Dry Gulch Creek (1 mi) in the vicinity of the Town of Durango in Southwestern Colorado. Drainage areas for the three streams' study reaches are: Animas River-765 square miles, Junction Creek-39 square miles, and Dry Gulch Creek-4 square miles. Floodplain width ranges from about 1/8 mile for Junction and Dry Gulch Creeks to 1/2 mile for the Animas River. Commercial, residential, and agricultural development exists in the floodplain, and some future development is predicted. Streamflow data for the Animas River are from a U.S. Geological Survey gage near the U.S. Highway 550. No gage information is given for Dry Gulch and Junction Creeks. Flooding is caused by runoff from spring snowmelt, localized cloudburst storms and rainstorms. Obstructions to flood flow include trees, brush, streambank vegetation, and three major highway bridges. The greatest flood in history occurred in June, 1927, with a peak discharge of 20,000 cubic feet per second (cfs) on the Animas River. The most recent heavy flooding occurred in October, 1972 on Junction Creek. The 100-year flood would have a peak discharge of 24,000 cfs on the Animas River and the 500-year flood would discharge 40,500 cfs. Average 100-year flood velocity of flow for the three streams could reach as high as 13 feet per second (fps) for the main channel and 4 fps for the overbank areas. (Arnold-NC)
W79-06532

FLOOD HAZARD INFORMATION: COLORADO RIVER, PALISADE, COLORADO.
Army Engineer District, Sacramento, CA.
Prepared for The Town of Palisade and Mesa County, CO., November 1976. 5 p, 31 plates, 1 tab.

Descriptors: *Floods, Flood profiles, *Flood plains, *Colorado River(CO), *Colorado, *Palisade(CO), Flooding, Flood flow, Indirect flood measurement, Storms, Cloudbursts, Historic floods, Flood data, Flood frequency, Flood damage, Erosion, Rivers, Floodways, Channels, Flood protection, Flood plain zoning, Mesa County(CO), 500-year flood, 100-year flood.

This report details flood hazard information for that portion of the Colorado River in the vicinity of the Town of Palisade in Mesa County east of the City of Grand Junction in extreme Western Colorado. The length of the study reach is about 10 miles from Interstate Highway 70 downstream to State Road 32. Drainage area is about 8,800 square miles above Palisade. Flood plain width varies from about 1,500-3,000 feet. Some residential and commercial development exists in the flood plain, although primary use is agricultural. Development is projected to be very slow, with a 10% increase projected by the year 2000. Causes of flooding are heavy spring, summer and fall rainstorms, and runoff from spring snowmelt. The most recent major flood occurred in 1957, although the 1884 flood is considered the area's most serious event. Major obstructions to flow include trees, brush and vegetation along the streambank, as well as highway bridges. Flood profiles are presented for the 100- and 500-year floods. The 100-year flood could cause the Colorado River to be out of its banks for almost the entire study area but would remain mostly within its natural flood plain; the 500-year flood would follow much the same pattern but would be deeper. Channel velocities of the 100-year flood would cause severe bank erosion. No structured control measures exist in the study reach; Mesa County has adopted flood plain regulations and Palisade has zoning ordinances but they do not address flood hazards. (Arnold-NC)
W79-06533

TWO-DIMENSIONAL SHALLOW WATER-WAVE MODELS,
Louisville Univ., KY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-06588

TRANSPORT OF REACTING ADMIXTURES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 5B.
W79-06613

INPUT-OUTPUT MODEL FOR RUNOFF-SEDIMENT YIELD PROCESSES,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W79-06617

ESTIMATING SEDIMENT TRANSPORT IN A BRAIDED GRAVEL CHANNEL--THE KAWERONG RIVER, BOUGAINVILLE, PAPUA NEW GUINEA,
Papua and New Guinea Univ., Port Moresby (New Guinea).
For primary bibliographic entry see Field 2J.
W79-06618

SYNTHESIS OF FLOW-DURATION CURVES FOR UNREGULATED STREAMS IN NEW HAMPSHIRE,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman.
Water Resources Bulletin, Vol. 14, No. 6, p 1481-1502, December 1978. 6 fig, 5 tab, 19 ref. OWRT A-040-NH (1), 14-31-0001-4029.

Descriptors: *Streamflow, *Variability, *Flow duration, New Hampshire, Curves, Streams, Watersheds(Basins), Data processing, Analytical techniques.

Flow-duration curves are concise pictures of flow variability at a point on a stream, and they provide essential information for all water resource planning. In New Hampshire, useful estimates of flow-duration curves for ungaged points on unregulated streams can be made using only information readily available from contour maps: (1) area of the basin above the point of interest; and (2) either the measured mean basin elevation or the elevations of the highest and lowest points in the basin. Measured or estimated mean basin elevation then is used in regression equations to estimate mean flow Q(mean) and the flow exceeded 95% of the time, Q sub 95. Q(mean) was assumed to occur at the 27% exceedance frequency. Q sub 02, Q sub 05, and Q sub 30 were estimated as multiples of Q(mean). Equations were provided for calculating 95% confidence intervals for future estimates using the method. The dependence of mean flow on elevation is due to positive vertical precipitation gradients and negative vertical evapotranspiration gradients. The dependence of Q sub 95 on elevation appears to be due largely to the fact that it rains more often, that snowmelt takes longer, and that evapotranspiration is reduced at higher elevations. (Sims-ISWS)
W79-06725

A PLANNING ALGORITHM TO ASSESS THE IMPACT OF URBAN GROWTH ON FLOOD EXPECTANCY,
Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
M. E. Smith, and D. O. Doehring.
Hydrological Sciences Bulletin, Vol 23, No 2, p 245-255, June 1978. 6 fig, 2 tab, 12 ref. OWRT B-147-COLO(2).

Descriptors: *Urbanization, *Flood frequency, Methodology, Analytical techniques, New England, Urban runoff, Algorithms, Regression analysis, Drainage area, Land use, Mathematical studies, *Flood expectancy, Urban growth impact, Morphometric parameters.

Standard engineering and planning practice regarding flood hazard delineation in the U.S. are based on the assumption that a 100-year flood is static and that it is not affected significantly by subsequent urbanization of the basin. Research reported in the paper demonstrated that this assumption is unjustified when hydrological response of a basin to extensive urban growth depends on geological and morphometric parameters. The causal relationships were synthesized into an algorithm which predicts the change in discharge in 50- and 100-year floods on the basis of indices of urban land use changes, surficial properties of the catchment, and the configuration of the drainage network. The algorithm was developed by a stepwise multiple regression technique, and it utilized data from 18 basins in southeastern New England. (Singh-ISWS)
W79-06726

EXTERNALITIES FROM URBAN GROWTH: THE CASE OF INCREASED STORM RUNOFF AND FLOODING,
Iowa Univ., Iowa City. Inst. for Economic Research.
J. R. Bernard.
Land Economics, Vol. 54, No. 3, p 298-315, August 1978. 3 fig, 1 tab, 27 ref. OWRT A-053-IA and B-055-IA (4) (1).

Descriptors: *Urbanization, *Flooding, *Urban-runoff, Iowa, Storm runoff, Flood damage, Property values, Watersheds(Basins), Model studies, Mathematical models, Econometrics, Flood plains, Social costs, Cost-benefit analysis.

Expansion of Iowa City, Iowa, has increased the runoff and flood hazard in nearby Ralston Creek watershed, and the flood hazard has negatively affected property values in the lower portion of the watershed. Hydrological and economic evidence thus shows that urban growth produces a negative externality in the form of increased flood hazard to downstream properties, primarily because of increases in the area of impervious surfaces, as well as a negative income distribution effect. Since estimated social costs from hazards of urbanization are relatively small compared with large and costly flood control or diversion schemes, such projects would involve unfavorable benefit-cost ratios. Upstream urban development should be controlled to avoid further increases in runoff, and older properties subject to flooding should be converted to uses compatible with the level of flood hazard, such as parks or parking lots. Detailed cost-benefit analysis would be needed to assess options. New design and planning methods for storm runoff control show promise of cost savings over conventional methods, while at the same time solving urban runoff problems. Two severe floods have occurred in the watershed in recent years, the latest in 1972. The influence of flood hazard was measured by an econometric model of property values. (Lynch-Wisconsin)
W79-06727

EFFECTS OF DRAINAGE PROJECTS ON SURFACE RUNOFF FROM SMALL DEPRESSIONAL WATERSHEDS IN THE NORTH CENTRAL REGION,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 796, Price codes: A11 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Bulletin 99. January 1979. 225 p, 40 fig, 9 tab, 110 ref, 7 append. OWRT B-122-MINN (1), 14-31-0001-6092.

Descriptors: *Surface runoff, *Wetlands, *Drainage, *Flood flows, Low flows, Watershed model, *Small watersheds.

Surface runoff from small watersheds characterized by numerous depressions was studied statistically and by use of a special purpose watershed model. The statistical analyses illustrated the possible magnitude of the storage effect exhibited by lakes, marshes and other depressions. Because of data limitations statistical techniques could not be used to examine the effects on flood runoff of draining these same areas. The model represents

the processes of snowmelt, infiltration, soil moisture storage, evapotranspiration, subsurface and surface runoff for four different land drainage conditions, with or without channel development. Application of the model to two small watersheds in Jackson County, Minnesota indicated that drainage development increases annual runoff, storm runoff and peak discharge. The physical characteristics of the main water course in the watershed was the major factor influencing peak discharge at the watershed outlet. Examination of annual flood flows on the Minnesota River at Mankato suggests that downstream effects of drainage development on large watersheds are much less than indicated by this study on small watersheds. Downstream effects and flooding within a watershed are discussed in general terms.
W79-06729

THE MEASUREMENT OF INTERACTIVE FRESHWATER AND TIDAL FLOWS IN THE RIVER DEE, NORTH WALES,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
For primary bibliographic entry see Field 2L.
W79-06747

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
D. O. Hodgins.
Journal of Hydraulic Research, Vol. 17, No. 1, p 23-41, 1979. 8 fig, 1 tab, 12 ref.

Descriptors: *Stratified flow, *Model studies, *Analytical techniques, Mathematical models, Analysis, Mathematical studies, Stability, Subcritical flow, Flow, Laboratory tests, Hydraulic models, Waves(Water), Water levels, Numerical analysis, Methodology, Estuaries, Lakes, Two-layer flow, Finite difference method.

An implicit finite difference method was described for solving the equations of motion of a two-layer stably stratified fluid in one dimension. The computational scheme is applicable to smoothly varying subcritical flows and is formulated in terms of layer transport and thickness in order to optimize computer efficiency. Stability analyses of the method show that waves forming at the grid scale are undamped and two approaches for controlling this wave growth were discussed. Comparisons with experimental data show the method to be accurate provided that the natural long wave motions are well resolved and the grid scale waves are filtered from the solutions. Numerical tests indicate a minimum of 20 points per wave length or period can be considered as a lower limit for resolution. (Humphreys-ISWS)
W79-06758

NEW INTERPRETATION OF SOME HEAD LOSS-FLOW VELOCITY RELATIONSHIPS FOR DEFORMABLE MOVABLE BEDS,
Grenoble-1 Univ. (France). Inst. de Mecanique.
J. P. Chollet, and J. A. Cunge.
Journal of Hydraulic Research, Vol. 17, No. 1, p 1-13, 1979. 9 fig, 8 ref, 3 append.

Descriptors: *Head loss, *River beds, *River flow, Velocity, Friction, Hydraulics, Sediment transport, Movement, Roughness(Hydraulic), Rivers, Dunes, Sands, *Movable beds, Deformable beds, Einstein method, Engelund method.

The roughness of movable beds, which are deformed by the formation of sand dunes, is not constant since bed topography is dependent on flow characteristics. The relationship between the energy dissipated by the flow and its average velocity deviates, therefore, from the quadratic form generally used to express hydraulically rough flow; nevertheless, it is possible to describe the general form of this relationship and then to determine its exact terms using the Einstein and Engelund methods. (Lee-ISWS)
W79-06760

EVALUATION OF HYDROLOGIC MODELING TECHNIQUES FOR FOREST LAND MANAGEMENT PLANNING,
Washington State Dept. of Natural Resources, Olympia.
J. A. Ryan.
Water Resources Bulletin, Vol. 15, No. 2, p 461-472, April 1979. 5 fig, 2 tab, 16 ref.

Descriptors: *Hydrology, *Simulation analysis, *Forest management, *Evaluation, *Mathematical models, Planning, Timber harvesting, Environmental effects, Ecosystems, Discharge(Water), Equations, Streams, Water temperature, Multicycle system, Systems analysis, Water quality.

A growing concern for environmental quality paralleled with increasing demands on our forest resources has prompted the Washington State Department of Natural Resources to evaluate simulation modeling as a technique for analyzing management decisions in terms of their environmental effects. The evaluation focused on a system of integrated models developed at the University of Washington which simulate processes and activities within the forest ecosystem. A major part of the system is a hydrologic model which predicts changes in discharge, stream temperature, and concentrations of suspended sediment and dissolved oxygen based on information generated by other models representing intensive management practices. The evaluation consisted of applying the system to a 72,000 acre watershed and determining the pertinence of hydrologic modeling for management purposes. Results show several potential uses of hydrologic modeling for forest management planning, especially for analyzing the effects of timber harvesting strategies on water quality. (Bell Graf-Cornell)
W79-06801

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
J. B. W. Day, and J. C. Rodda.
Proceedings of the Royal Society of London, Series A, Vol. 363, No. 1712, p 55-68, 1978. 10 fig, 11 ref.

Descriptors: *Droughts, *Europe, *Water level fluctuations, *Water storage, Water shortage, Water levels, Precipitation, Aquifers, Hydrographs, Water wells, Withdrawal, Surface-groundwater water relationships, Base flow, Ground water recharge, Conjunctive use, England.

Approximately one-third of the water used for public supply in England and Wales is ground water. During the 1975-76 drought, water levels and storage in the major aquifers, the Chalk and the Triarsic sandstones, generally declined. In unconfined aquifers levels were a few meters below normal, but in confined aquifers with less storativity, levels dropped more than 10 meters. By August, 1976, record low levels were being registered in many wells due possibly to the effect of pumping. Water levels in some aquifers, particularly the Chalk, did not respond immediately to precipitation at the end of the summer. By the spring of 1977, ground water levels were at or above those of the previous four years, except in areas with previous overdraft. No permanent or long-term adverse physical or chemical effects on the aquifers have been noted thus far. Exploitation of ground water in deep storage during a drought would be difficult due to high cost, limited drilling facilities, deterioration of quality, decreases in stream baseflow, and possible reduction in well yield due to decreased permeability. Conjunctive use of surface and ground water and use of poor-quality water from shallow aquifers for non-potable purposes are more promising drought prevention measures. (Purdin-NWWA)
W79-06807

RUNOFF RAINFALL ANALYSIS FOR BARE SOILS,
Israel Soil Conservation and Drainage Div., Emek Hefer; and Weizmann Inst. of Science, Rehovoth (Israel). Computer Center.
J. Morin, and H. S. Jarosch.
Israel, Soil Erosion Research Station, Emek Hefer, Pamphlet No. 164, 1977, 22 p, 2 fig, 4 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Surface runoff, *Watershed managements, *Depth-area-duration analysis, *Surface-groundwater relationships, Storm runoff, Discharge(Water), Rainfall intensity, Runoff coefficient, Runoff forecasting, Time series analysis, Infiltration, Soil erosion, Vegetation effects, Soil conservation, Forecasting, Simulated rainfall, Design criteria, Infiltration rates.

A detailed quantitative analysis of rainfall-runoff relationships on small watersheds is of vital importance in soil conservation programs. A method is described here for predicting the quantity and discharge of runoff from cultivated areas which makes possible the analysis of real long-term rainfall data for a certain zone in order to obtain the synthetic runoff values on the basis of probability. Rainfall intensity data collected by the Israel Hydrological Service was computer-analyzed on the basis of relationships obtained from field experiments with rain simulation on characteristic soils and methods of cultivation. The prediction of runoff by the method described here is divided into and analyzed in three stages: (1) analysis of rain, (2) runoff under uniform infiltration conditions, and (3) runoff with varying infiltration rates of the soil. Results of analysis have shown that crust formation and wetting, and that for most soil types in the Mediterranean and other semiarid zones, runoff consists of surface flow with almost no components of underground horizontal flows. It is the opinion of these authors that the method of predicting discharge and runoff volume utilizing the combination of infiltration curves obtained by artificial rain systems together with the analysis of actual rain data, which they describe, is a promising approach for quickly obtaining design parameters which are based upon long-term probability. (Tickes-Arizona)
W79-06837

STREAM NETWORK ANALYSIS AND GEOMORPHIC FLOOD PLAIN MAPPING FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY APPLICATION TO FLOOD HAZARD STUDIES IN CENTRAL TEXAS,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 7B.
W79-06877

URBAN STORM WATER MANAGEMENT: DISTRIBUTION OF FLOOD VOLUMES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
S-O. Chan, and R. L. Bras.
Water Resources Research, Vol. 15, No. 2, p 371-382, April 1979. 19 fig, 3 tab, 14 ref.

Descriptors: *Urban hydrology, *Storm water, *Flood volumes, *Frequency distribution, *Rainfall, Management, Overflow, Sewers, Hydrologic data, Hydrographs, Simulation analysis, Runoff, Equations, Intensity, Duration, Systems analysis, Joint probability density function, Closed analytical form, Annual exceedance series, Kinematic wave functions, Design.

The frequency distribution of the volume of water above a given threshold discharge is developed. This is done using basic and accessible information like the joint probability density function of rainfall intensity and duration together with expressions, to be derived, relating the volume of interest to rainfall intensity and duration. The resulting distribution function is in a closed analytical form containing only a few climatological and physical parameters of a catchment. This distribution function will be of great value in the design of storage devices, flood control systems, and storm water treatment facilities in urban areas. (Bell Graf-Cornell)
W79-06934

A COMPARISON OF THREE FLOODING REGIMES, ATCHAFALAYA BASIN, LOUISIANA,
Coastal Environments, Inc., Baton Rouge, LA.
For primary bibliographic entry see Field 4A.
W79-06943

2F. Groundwater

PROGRAMMING A POCKET CALCULATOR FOR SOLVING MULTIPLE WELL, VARIABLE PUMPING RATE PROBLEMS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 7C.
W79-06593

CHANGING PATTERNS OF GROUND-WATER USE IN THE UNITED STATES,
NSF Science for Citizens Program, Madison, WI.
For primary bibliographic entry see Field 7C.
W79-06594

GROUND-WATER COMPUTER MODELS--STATE OF THE ART,
Camp, Dresser and McKee, Inc., Champaign, IL. Water Resources Div.
T. A. Prickett.
Ground Water, Vol 17, No 2, p 167-173, March-April 1979. 80 ref.

Descriptors: *Computer models, *Groundwater, *Model studies, *Technology, Methodology, Research and development, Analytical techniques, Numerical analysis, Finite element analysis, Analog models, Finite difference models.

The 3 main characteristics that put the use of groundwater models into the class of intellectual toys are as follows. First, the wrong model is frequently chosen for problem-solving, of which overkill by use of an overly sophisticated model is an example. Secondly, the paying agency or client is often disillusioned with the model results because of frequent modeler oversell in the early stages of project planning and budgeting. Thirdly, the problems are often solved with a numerical code that is a mystery to all except the modeler himself. The 3 main characteristics that make groundwater models very practical tools are as follows. First, there is no doubt that the models of today can solve extremely complex groundwater flow problems. Second, the models of today are available to virtually everyone in the groundwater business. And third, having a computer code and data deck available is a perfect tool for transferring information to another person as to how a problem was solved. This paper also included a very brief description of the state-of-the-art of groundwater modeling and a very comprehensive reference list of useable models. (Visocky-ISWS)
W79-06595

NONSTEADY FLOW TO NONPENETRATING WELL,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
R. S. Kanwar, H. P. Johnson, and H. S. Chauhan.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14458, p 45-55, March 1979. 4 fig, 2 tab, 16 ref, 2 append.

Descriptors: *Aquifer characteristics, *Wells, *Unsteady flow, Aquifers, Drawdown, Hydraulic conductivity, Penetration, Hydraulics, Pump testing, Transmissivity, Flow, Steady flow, *Nonequilibrium flow, Well hydraulics.

A nonequilibrium formula was obtained to predict the nonsteady drawdown distribution near a cavity well discharging from a nonleaky artesian aquifer. A graphical method was suggested to find such aquifer properties as specific storage coefficient and hydraulic conductivity. The practical utility of this method was demonstrated by utilizing the pumping test data for a particular aquifer. The results of the pumping tests were given, and the values of hydraulic conductivity and specific storage were compared with the well-known method of Theis. If the values of aquifer properties are found to be satisfactory from this solution, the use of other methods that require the drilling of fully penetrating wells could be avoided easily, which will make the cost of investigation of aquifer properties reasonably small. (Lee-ISWS)
W79-06607

OBSERVATIONS OF THE SUBSURFACE WATER REGIME IN THE TERRITORY OF CZECHOSLOVAKIA,
H. Kriz, and I. Krizova.
Water Resources, Vol. 4, No. 6, p 952-956, November-December 1977. 1 fig, 1 tab, 4 ref. Translated from Vodnye Resusry, No. 6, p 187-192, November-December 1977.

Descriptors: *Subsurface waters, *Groundwater, *Wells, *Springs, Observation wells, Water wells, Water levels, Water supply, Water resources, On-site investigations, Precipitation(Atmospheric), Hydrologic data, Hydrology, Hydrogeology, *Czechoslovakia.

A study of the subsurface water regime in the territory of modern Czechoslovakia began later than hydrologic observations, mainly observations of the level of rivers. Single measurements of the discharge of certain large springs were made as long ago as 1881-1890, but systematic observations of the subsurface water regime for water supply and other water management purposes began only at the turn of the century. The fact is that purposeful observations were primarily irregular and brief. The sole exceptions are the long-term observations of the level of subsurface waters and discharge of springs which have been carried out since the turn of the century in the southern part of the Ceska Trebova Highlands. These observations in the territory of Czechoslovakia do not have an analogy, and from the viewpoint of duration are unique on a worldwide scale. Observations in 10 wells began as long ago as at the end of 1899 and in the ensuing years gradually encompassed other installations. Measurements of the discharge of the first two springs (Sulka spring in Brezov near the Svitava River and Nadrazin spring in the village of Brnenc) began in 1900. The results of these unique observations are of great value, because they permit judging the changes in the supply of subsurface waters in the indicated part of Czechoslovakia during 76 years. (Sims-ISWS)
W79-06609

ALTERATION OF HYDROGEOLOGIC CONDITIONS DURING MINING OF MINERAL DEPOSITS AND WATER-RESOURCE CONSERVATION MEASURES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology (USSR).
For primary bibliographic entry see Field 5G.
W79-06615

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-06738

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
R. L. Guthrie, and B. F. Hajek.
Soil Science Society of America Journal, Vol. 43, No. 1, p 142-144, January-February 1979. 2 fig, 3 tab, 10 ref.

Descriptors: *Water levels, *Groundwater, *On-site investigations, *Perched water, *Alabama, Soils, Water level fluctuations, On-site tests, Methodology, Soil horizons, Measurement, Instrumentation, Precipitation(Atmospheric), Dothan soil, Mottled soils, Plinthite.

The water regime in a Dothan soil was characterized by installing piezometers at 137-, 183-, and 285-cm depths. Monthly water table measurements differed for each piezometer throughout a 4-year study period, indicating a perched water table. There was a water table at the greatest depth on only 5 occasions during the study period. On all but a few occasions, a water table was encountered at the 2 shallower depths. Morphological properties and seasonal precipitation were related to the water regime. The perched water table fluctuated in a continuous zone of saturation in the B horizon above the horizons containing appreciable amounts of plinthite. A discontinuous zone of saturation was bounded on the bottom by the B3 horizon. The piezometer that had perforations in the C horizon showed no water table, which indicated that a 'dry' zone exists between the perched and regional groundwater tables. Fluctuations in the depth to perched water corresponded to seasonal precipitation patterns. (Humphreys-ISWS)
W79-06742

A DRAINAGE MODEL FOR A RECLAIMED SURFACE MINE,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 4A.
W79-06743

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06769

THAT SINKING FEELING.
Ground Water Age, Vol. 13, No. 8, p 23-24, 42, April, 1979.

Descriptors: *California, *Land subsidence, *Artesian heads, Groundwater, Pumping, Damages, Flood control, Levees, Recharge, Compaction.

The central third of the Santa Clara Valley in California experienced one to eight feet of subsidence from 1934 to 1967 due to withdrawal of ground water from a confined aquifer. Changes in rate and magnitude of artesian head decline caused geographic variations in subsidence rate and magnitude with time. Subsidence has necessitated construction of levees near the coast, repairing damaged wells, railroads, bridges, and roads, establishing and releveling a bench mark network, and making private engineering surveys. To date, $15-20 million have been spent on these problems. Between 1967 and 1975 artesian head recovered 104 feet due to increased water imports, favorable local water supply, decreased pumpage, and increased recharge. The most significant factor was the increase of imports from 30,000 to 148,000 acre feet per year. The rate of subsidence decreased to a fraction of an inch per year as a result of the dramatic head recovery. Compaction is irreversible but by raising the artesian head in the aquifers until it equals or exceeds the maximum pore pressure in the aquitards, additional compaction and subsidence can be stopped. (Purdin-NWWA)
W79-06804

HYDROGEOLOGICAL TESTING ASSOCIATED WITH UNDERGROUND COAL GASIFICATION,
Alberta Research Council, Edmonton. Ground Water Div.
For primary bibliographic entry see Field 8E.
W79-06806

ON THE AQUIFER'S INTEGRATED BALANCE EQUATIONS,
Princeton Univ., NJ. Dept. of Civil Engineering.
J. Bear.
Advances in Water Resources, Vol. 1, No. 1, p 15-23, September 1977. 11 ref, append.

Descriptors: *Aquifers, *Balance equations, *Continuity equation, *Hydrodynamics, *Dispersion, Methodology, Transport phenomena, Porous media, Water flow, Solutes, Groundwater.

A general methodology is presented for describing transport phenomena in porous media at a macroscopic level. Then, these macroscopic balance equations are integrated (or averaged) along the vertical for confined, leaky and phreatic aquifers. The results are employed to derive (averaged) aquifer equations for the flow of water and of a solute (hydrodynamic dispersion). It is shown that in all cases, the resulting equation is identical to that derived on the basis of an assumption of horizontal flow (the Dupuit assumption). Macrodispersion, occurring at the aquifer level, is discussed and appropriate coefficients are proposed. (Bell Graf-Cornell)
W79-06811

GROUND-WATER LEVELS IN NEW MEXICO, 1976,
Geological Survey, Albuquerque, NM. Water Resouces Div.
J. D. Hudson.
New Mexico State Engineer Basic Data Report, 1978. 184 p, 35 fig, 56 tab.

Descriptors: *Groundwater levels, *New Mexico, *Water wells, *Water level fluctuations, *Hydrographs, Geologic units, Springs, Artesian heads, Groundwater resources, Bibliographies, Publications.

Water levels are measured periodically in a network of about 5,000 observation wells to record changes in ground-water storage in New Mexico. About 1,000 wells are measured annually and the remaining 4,000 wells are scheduled to be measured at 5-year periods, staggered so that a portion are measured each year. The areas of water-level observation are within seven of the nine major surface-water drainage basins; most are in areas where ground water is used in large quantities for irrigation, municipal, or industrial purposes. Measurements tabulated in this report were made in January through May 1977, except the Tatum-Lovington-Hobbs area in Lea and Chaves Counties, which has both 1977 and previously unreported 1976 water levels. Maps show water-level changes for most of the areas reporting 5-year water-level changes. The program of groundwater observation conducted by the U.S. Geological Survey is in cooperation with the State Engineer of New Mexico; resulting data are used in evaluating the ground-water resources of the State. Included is a bibliography of papers and publications pertaining to ground water in New Mexico published or released to the open file in 1976, with additions from 1873-1975. (Woodard-USGS)
W79-06828

THE OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER, GRAND STRAND AREA AND SURROUNDING PARTS OF HORRY AND GEORGETOWN COUNTIES, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06831

SOME PROBLEMS IN EVALUATING THE ABILITY OF STRATA TO STORE OR TRANSMIT POLLUTANTS,
Manchester Univ. (England). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 5B.
W79-06862

FORMATION FINES AND FACTORS CONTROLLING THEIR MOVEMENT IN POROUS MEDIA,
Exxon Production Research Co., Houston, TX.
T. W. Muecke.
Journal of Petroleum Technology, Vol. 31, No. 2, p 144-150, February 1979. 11 fig, 1 tab, 5 ref.

Descriptors: *Wells, *Clogging, *Porous media, Migration, Fines, Sand aquifers, Unconsolidated aquifers, Sandstones.

Unconsolidated sandstone formations contain large amounts of very small, loose, solid particles that vary widely in size and chemical composition. These particles can concentrate at pore restrictions causing severe plugging and reductions in formation permeability. The effects of single-and multiphase fluid flow on fine-particle movement in porous media are discussed. The onset of water production can cause fines to move and lead to well productivity problems. Injection of water or solvent, surfactant solutions often leads to at least temporary removal of near-wellbore damage. Chemical systems designed to permanently remove or stabilize fine particles must be capable of treating a broad range of particles having widely different compositions. Besides mechanical bridging, particle wettability and surface/interfacial forces strongly influence particle mobility when multifluid phases are present. Particles will move only if the phase that wets them is moving. Thus, it may be possible to control fines movement with permanent coatings of the right material on sand grain surfaces. (Purdin-NWWA)
W79-06864

GROUNDWATER LEVELS AND PUMPAGE IN THE EAST ST. LOUIS AREA, ILLINOIS, 1972-1977,
Illinois State Water Survey, Urbana.
J. T. Emmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 043, Price codes: A03 in paper copy, A01 in microfiche. Circular 134, 1979. 23 p, 17 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Groundwater, *Illinois, *Data collections, *Mississippi River, *Water levels, Discharge(Water), Groundwater resources, Water supply, Aquifers, Sand aquifers, Alluvial aquifers, Water table aquifers, Municipal water, Domestic water, Well data, Potentiometric level, Surface waters, Water wells, *Alton(IL), *Wood River(IL), *Granite City(IL), *National City(IL), *Monsanto(IL).

Groundwater levels and pumpage in the East St. Louis area from 1972 through 1977 were considered in this report. Large quantities of groundwater chiefly for industrial and municipal use were withdrawn from wells penetrating a sand and gravel aquifer along the valley lowlands of the Mississippi River. Groundwater pumpage decreased from 79.5 million gallons per day (mgd) in 1971 to 65.3 mgd in 1977. Of the total 1977 pumpage, 79% was industrial; 16% was for public water supplies; 3.7% was for domestic use; and 1.3% was for irrigation. Pumpage in the East St. Louis area is concentrated in 5 major pumping centers: the Alton, Wood River, Granite City, National City, and Monsanto areas. As a result of reduced groundwater pumpage, near normal precipitation, and high Mississippi River stages, water levels rose as much as 35 feet in the Monsanto area near the Mississippi River and 15 feet in the Alton area. As a result of decreased pumpage in one area and increased pumpage in another area, water levels in the Granite City area rose 5 feet in one location and declined 5 feet in another location. In the National City area, water levels rose 10 feet in one area and declined 10 feet in another area. In the Wood River area, water levels rose 20 feet in one area because an industry changed the location of its groundwater source. (Humphreys-ISWS)
W79-06890

NUMERICAL MODEL FOR LAND SUBSIDENCE IN SHALLOW GROUND WATER SYSTEMS,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Publication No. LBL-4461, December 1976. 10 p, 12 fig, 10 ref.

Descriptors: *Finite difference analysis, *Land subsidence, *Compaction, Aquifers, Groundwater, Porous media, Flow systems.

The finite difference method is employed to simulate compaction of aquifers due to withdrawal of ground water. The model combines a general three-dimensional fluid flow field with a one-dimensional, vertical deformation of the porous medium. The governing equation is solved using a mixed explicit-implicit iteration scheme for advancing in the time domain. The model can handle heterogeneous flow regions with complex geometry, and with time dependent variation of material properties and boundary conditions. Five hypothetical cases are provided to demonstrate the applicability of the model to the wide variety of conditions associated with land subsidence. (Purdin-NWWA)
W79-06912

ELECTRO-OSMOSIS IN GROUND WATER POLLUTION CONTROL,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W79-06913

APPROXIMATE ANALYSIS OF UPCONING,
Princeton Univ., NJ. Dept. of Civil Engineering.
H. Rubin, and G. F. Pinder.
Advances in Water Resources, Vol. 1, No. 2, p 97-101, December 1977. 3 fig, 4 ref.

Descriptors: *Upconing, *Saline water-freshwater interfaces, *Coastal aquifers, *Groundwater, *Flow, *Salinity distribution, Effects, Wells, Equations, Free surface flow, Unsteady state, Cylindrical coordinates, Pumping, Dispersion.

The change of the salinity distribution in coastal aquifers due to pumpage is often described as an upconing of the interface between saline and fresh water. Sea and fresh water are miscible fluids, however. Therefore, dispersion of salinity in the aquifer affects the upconing process. An estimate of the effect of salinity dispersion on the dynamics of the flow as well as on the salinity distribution in the aquifer is presented herein. The phenomenon is described as a migration of sharp interface perturbed by small disturbances due to salinity dispersion. The creation of the mixing zone between fresh and saline water is described as a formation of a boundary layer in the vicinity of the sharp interface. This method is primarily recommended for the flow fields in which simple representation of the sharp interface migration is obtainable. (Bell-Graf Cornell)
W79-06920

SIMULATION OF GROUNDWATER FLOW AND MASS TRANSPORT UNDER UNCERTAINTY,
Princeton Univ., NJ. Water Resources Program.
D. H. Tang, and G. F. Pinder.
Advances in Water Resources, Vol. 1, No. 1, p 25-30, September 1977. 3 fig, 11 ref.

Descriptors: *Groundwater, *Flow, *Simulation analysis, *Mass transport, *Uncertainty, Stochastic processes, Analytical techniques, Waves(Water), Probability, Wells, Equations, Systems analysis, Contaminant transport, Perturbation approach.

An analytical tool which facilitates the analysis of stochastic groundwater problems without resorting to Monte Carlo analysis can be developed using an approach analogous to that used in the field of applied mathematics to investigate the propogation of waves in random media. The fundamental as-

sumption of this approach is that the random part of the porous medium property is small compared to the non-random part. This assumption allows us to treat the problem of solving a partial differential equation with stochastic coefficients using perturbation theory. (Bell Graf-Cornell)
W79-06922

2G. Water In Soils

SURFACE STORAGE ON BEDDED CULTIVATED LANDS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
G. A. Gayle, and R. W. Skaggs.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 1, p 101-109, January-February 1978. 5 fig, 2 tab, 8 ref. OWRT-A-086-NC(5). 14-34-0001-7070.

Descriptors: *Storage, *Depression storage, *Runoff, *North Carolina, *Drainage, Soils, *Storage capacity, Infiltration, Evaporation, Surfaces, Water storage, Rainfall, Precipitation(Atmospheric), Agriculture, Farm management, On-site investigations, Hydrology, Micro-storage, Macro-storage.

Surface depressional storage was characterized for three field soils by measuring both micro and macro components at various times during the year. Measurements were made on both land formed and non-land formed fields. Micro-storage was measured by sealing the soil surface in small plots and determining the amount of water that could be applied before runoff began. The macro-storage component was measured by closely spaced surface elevation measurements. The range in macro-storage was from 1.1 mm for a land-formed soil to 33 mm for a natural sloped field. The micro-storage was dependent on soil type, slope, and time of year, but ranged from 0.6 to 19 mm. Based on the cases examined, flat lands in the North Carolina Tidewater Region may be expected to have macro-storage values of about 15 mm or greater under natural conditions. When potholes are eliminated, either by land forming or simply filling the depressions, macro-storage can be reduced to less than 5 mm. (Sims-ISWS)
W79-06503

SERIOUS INTERFERENCES IN THE DETERMINATION OF TRACE METALS IN SOILS BY FLAME AND FLAMELESS ATOMIC ABSORPTION SPECTROMETRY,
Montana Coll. of Mineral Science and Technology, Butte. Dept. of Chemistry.
A. Mubarak, L. Hageman, R. A. Howald, and R. Woodriff.
Soil Science Society of America Journal, Vol 42, No 6, p 889-891, November-December, 1978. 5 tab, 14 ref.

Descriptors: *Trace elements, *Spectrometers, Chemical analysis, *Soil chemistry, Absorption.

Negative interfering effects on the carbon rod atomizer (CRA) absorbances of Mn, Fe, and Ni were found to occur in the presence of the chlorides of the major cations (Ca, Mg, Na) in the soil solution. These interferences were corrected either by precipitation of the chlorides with silver nitrate or by incorporating a relatively high level of sulfuric or nitrice acid into the sample volume. Magnesium ion, irrespective of the associated anion, was found to lower the Cd signal on the CRA. High concentrations of MgSO4 caused lowering of the Mn signal when using air-acetylene flame. This lowering effect of MgSO4 was avoided upon using N2O-acetylene flame. No interferences were noticed for Mn and Zn when using the constant temperature furnace developed at Montana State University. (Skogerboe-Colorado State)
W79-06555

OXYGEN FLUX MEASUREMENT IN UNSATURATED SOILS,
Malcomess Ltd., Isando (South Africa).
J. M. Rankin, and M. E. Sumner.
Soil Science Society of America Journal, Vol 42, No 6, p 869-873, November-December, 1978. 3 fig, 3 tab, 12 ref.

Descriptors: *Oxygen, *Soil gases, Diffusion, Aeration, Deaeration, Oxidation-reduction potential, Electrodes, Instrumentation, Electrical resistance.

Because in unsaturated soil systems the plateau of the current-voltage curve is not well developed or is absent, O2 reduction at the platinum microelectrode is not diffusion controlled and consequently measured current depends continuously on applied potential. To overcome this difficulty an O2 flux meter was designed which carefully controls and measures the applied potential and enables the effective potential at the electrode to be measured precisely. The instrument, which has facilities for measuring soil electrical resistance, electrode redox potential, and O2 reduction current was fully described together with a circuit diagram. Because the surface oxide condition of the microelectrode is crucial to reproducible results, electrode pretreatment involving gentle abrasion in wet fine sand is necessary to standardize conditions prior to measurement. The results showed that the instrument is suitable for measuring O2 flux in unsaturated systems, and that measured current was closely related to soil airspace. (Skogerboe-Colorado State)
W79-06556

A UNIVERSAL DIMENSIONLESS PHOSPHATE ADSORPTION ISOTHERM FOR SOIL,
Arya-Mehr Univ. of Technology, Tehran (Iran).
A. Shayan, and B. G. Davey.
Soil Science Society of America Journal, Vol. 42, No. 6, p 878-882, November-December, 1978. 3 fig, 1 tab, 20 ref.

Descriptors: *Adsorption, *Phosphates, Isotherms, Kaolinite, Chemical potential, Fertilizers, Soil chemistry.

A unique dimensionless phosphate adsorption isotherm, covering the solution concentration range 0.000001 to 0.1M P, which has been found to fit 17 materials including 15 soils, pure kaolinite and amorphous Al(OH)3, was derived. The soils shown to fit the isotherm included chromic luvisols, pellic vertisols, calcic luvisols, a tropeptic eutrorthox, a volcanic ash soil from New Zealand, and a number of English soils. The necessary parameters to derive a complete adsorption isotherm for a particular soil, from the universal isotherm, required three adsorption experiments in the high concentration range (0.000001 to 0.0001M P) to define the linear portion of the isotherm and the critical concentration. Three other determinations in the range 0.000001 to 0.0001M P were needed to obtain the Freundlich isotherm from the data after correction for the effect of the linear region of the isotherm at high concentration. The advantage of this universal isotherm over conventional isotherms, is that it requires less experimental work to define and is applicable over a wide range of P concentrations such as might be found surrounding a fertilizer granule. (Skogerboe-Colorado State)
W79-06557

TRANSIENT SEEPAGE ANALYSIS OF GURI DAM,
Harza Engineering Co., Chicago, IL. Hydrology Analysis and Design Div.
For primary bibliographic entry see Field 8A.
W79-06587

VARIABLE DRAINABLE POROSITY IN DRAINAGE DESIGN,
Indian Agricultural Research Inst., New Delhi (India). Div. of Enginerring.
A. K. Bhattacharya, and R. S. Broughton.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14433, p 71-85, March 1979. 6 fig, 7 tab, 25 ref, 2 append.

Descriptors: *Drainage, *Soil water, *Porosity, On-site investigations, Laboratory tests, Soil moisture, Soil water movement, Water table, Water levels, Soils, Clays, Sands, Soil properties, Bulk density, Subsurface drainage, Tensiometers, Hydraulic transients, Hydraulic conductivity, Soil science.

Field and laboratory investigations were done to study the dependence of drainable porosity on the suction in two different types of soil. Empirical nonlinear relationships were developed between the two. These relations were different for the sand and the clay soils. The relations were integrated between various limits to obtain the volume of water drained from saturated soil columns for different water table drawdowns. The results thus obtained were used to derive water table, depth-transient water content relations for soil columns of known lengths. These relations can be used to predict water table depth from the known value of transient water content in a soil column, in the water balance approach for subsurface drainage design. The effect of depth of installation of subsurface drains on the soil moisture depletion in coarser soils was examined. (Sims-ISWS)
W79-06605

THE EFFECT OF DISCHARGE RATE AND INTERMITTENT WATER APPLICATION BY POINT-SOURCE IRRIGATION ON THE SOIL MOISTURE DISTRIBUTION PATTERN,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
I. Levin, P. C. van Rooyen, and F. C. van Rooyen.
Soil Science Society of America Journal, Vol. 43, No. 1, p 8-16, January-February 1979. 9 fig, 4 tab, 14 ref.

Descriptors: *Soil water, *Irrigation, *Model studies, *On-site investigations, *Laboratory tests, Soil water movement, Diffusivity, Distribution patterns, Soil moisture, Hydraulic conductivity, Soils, Wetting, Mathematical models, Computer models, Water loss, Evaporation, Point-source irrigation, Trickle irrigation.

A comparison was made between the results of laboratory and field experiments regarding predictions of soil moisture distribution from a point source and those predictions theoretically calculated by a computer simulation model. Good agreement was found between computed and experimental data. When the verified model was used for predictions regarding soil water distribution under point-source irrigation, it was found that when the same total amount of water (12 liters) was added to the soil with a 2, 4, or 8 liters/hour continuously applied trickle source, a loss of 26% of the total amount applied was effected below the 60 cm depth after 12 hours. The initial water content of the soil was adjusted to the field capacity value. Under identical conditions, 1 liter/hour continuously applied and 2 liters/hour pulsed (intermittent) irrigation resulted in only a 12% loss. The lateral distribution of the water showed that in the first group of treatments, 80% of the water in the wetted soil volume was distributed 45 and 43 cm horizontally from the point source after 12 and 24 hours respectively. In the second group of treatments, the distribution was to 29 and 40 cm. Thus, the second group of treatments showed a clear advantage in reducing water loss under the root zone while still not significantly affecting the horizontal distribution. The pulse treatment, therefore, can replace the advantageous low (1 liter/hour) discharge rate while to a large extent avoiding the difficulties of blocking of outlets by maintaning a higher (2 liter/hour) discharge rate. (Sims-ISWS)
W79-06660

FLOW PATTERNS DURING EXTENDED SATURATED FLOW IN TWO, UNDISTURBED SWELLING CLAY SOILS WITH DIFFERENT MACROSTRUCTURES,
Soil Survey Inst., Wageningen (Netherlands).
J. Bouma, and J. H. M. Wosten.
Soil Science Society of America Journal, Vol. 43, No. 1, p 16-21, January-February 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soils, *Soil water, *Laboratory tests, Soil water movement, Porosity, Pores, Clays, Saturated flow, Saturated soils, Data processing, Analytical techniques, Soil science, Breakthrough curves, Swelling soils, Soil columns, Soil macrostructure.

Large, undisturbed soil columns with an average height of 30 cm, a diameter of 25 cm, and with two different types of macrostructure were sampled in moist clay soil. Type 1 had vertical worm channels and 'rough' peds; type 2 had no worm channels and 'smooth' peds. Flow patterns were characterized by repeatedly measuring K sub sat and chloride breakthrough curves. Effective pore size distributions were calculated from the latter with the Klinkenberg procedure. Initial chloride breakthrough was most rapid in soil columns of type 1 after displacement of less than 1 vol. % of the initial water, whereas 3 vol. % was displaced in type 2. Rapid chloride breakthrough was associated with a high volume of immobile water (60 vol. % and 2 vol. % for types 1 and 2 respectively). These phenomena can be explained by the presence of relatively large, continuous pores (particularly in type 1), that occupy only a small volume, as was confirmed by micromorphometric analysis and calculations of effective pore diameters. Application of a gypsum crust on soil columns of type 1 erased the differences with type 2. Crusts induced pressure potentials of -5 mbar, thus excluding the largest pores only. Extended ponding and associated continued swelling of peds did not change flow phenomena in type 1; in type 2, K sub sat, the volume of immobile water and the effective pore diameters gradually decreased. Equivalent pore diameters, calculated from the soil moisture characteristic, were quite different from the effective diameters and could not be used to independently predict the breakthrough curves. (Sims-ISWS)
W79-06661

EVALUATION OF CONCEPTUAL MODELS FOR DESCRIBING NONEQUILIBRIUM ADSORPTION-DESORPTION OF PESTICIDES DURING STEADY-FLOW IN SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
P. S. C. Rao, J. M. Davidson, R. E. Jessup, and H. M. Selim.
Soil Science Society of America Journal, Vol. 43, No. 1, p 22-28, January-February 1979. 6 fig, 4 tab, 23 ref. EPA R-803849.

Descriptors: *Pesticides, *Herbicides, *Soils, *Adsorption, Soil water, Soil water movement, Solutes, Model studies, Mathematical models, Laboratory tests, Pollutants, Path of pollutants, Water pollution, Soil science, Breakthrough curves.

Breakthrough curves (BTC) from miscible displacement of 2 pesticides through 3 soils were measured for 2 input concentrations of each pesticide. These BTC data were used to evaluate 2 conceptual models for describing the nonequilibrium adsorption-desorption of pesticides in soils under steady-state water flow conditions. In both models, adsorption on one group of sites was assumed to be instantaneous, while the rate of adsorption on the second group of sites followed either nonlinear reversible kinetics (Model I) or was a diffusion-controlled process (Model II). Parameters in both models were estimated by curve-fitting model predictions to one set of measured BTC data using a nonlinear least-squares optimization procedure. These parameter values then were used to verify the conceptual models by comparing simulated and measured BTC for a different input concentration. A different set of model parameters were required to describe the BTC data for each input concentration for the same soil-pesticide combination. The measured 3H20 BTC for all 3 soils were symmetrical in shape with no apparent tailing. Evaluation of Model I and II using these BTC suggested that the mobile-immobile water concept may not be applicable to the three soils used in this study. (Sims-ISWS)
W79-06662

SEASONAL WATER USE BY WINTER WHEAT GROWN UNDER SHALLOW WATER TABLE CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
B. C. Saini, and B. P. Ghildyal.
Agricultural Water Management, Vol 1, No 3, p 263-276, November, 1978. 10 fig, 1 tab, 27 ref.

Descriptors: *Water requirements, *Soil water movement, Shallow water, Moisture tension, Moisture content, Root zone, Tensiometers, Moisture deficit, *Wheat.

Techniques for estimating seasonal water use from soil profile water depletion frequently do not account for flux below the root zone. A method using tensiometers for obtaining evapotranspiration losses from the root zone and water movement below it was discussed. Soil water flux below the root zone was approached by a sequence of pseudo steady state solutions of the flow equation. Upward soil water flux contributed 36 to 73% to the total water requirement of winter wheat (Triticum aestivum L.) whereas soil water depletion accounted for 11 to 19% only. Water use efficiency with one irrigation during an early stage of plant development was greater than with no or three irrigations. This was the result of both decrease of resistance due to soil moistening and better root development. Tensiometer readings were also interpreted to estimate root zones, water table depths and soil moisture contents. Methods described in this paper can be used in determining seasonal water use by growing crops, replacing or supplementing lysimeter or meteorology approaches to this problem. (Skogerboe-Colorado State)
W79-06691

CONVECTIVE TRANSPORT OF SOLUTES BY STEADY FLOWS 1. GENERAL THEORY,
Institute for Soil Fertility, Groningen (Netherlands).
P. A. C. Raats.
Agricultural Water Management, Vol. 1, No. 3, p 201-218, November, 1978. 3 fig, 1 tab, 10 ref.

Descriptors: *Soil water movement, Solutes, Convection, Steady flow, Theoretical analysis, Anisotropy, Travel time, Leaching.

A comprehensive theory describing convective transport of solutes was presented. The time required for a parcel of water to move from one point to another along a streamline was determined, and this basic information was then used to describe collections of parcels of water forming a surface. Input/output relationships were determined in terms of the distribution of the solute over the inflow and outflow surfaces. A simple geometric transformation was used to extend the theory to anisotropic media. (See also W79-06693) (Skogerboe-Colorado State)
W79-06692

CONVECTIVE TRANSPORT OF SOLUTES BY STEADY FLOWS II. SPECIFIC FLOW PROBLEMS,
Institute for Soil Fertility, Groningen (Netherlands).
P. A. C. Raats.
Agricultural Water Management, Vol. 1, No. 3, p 219-232, November, 1978. 5 fig, 31 ref.

Descriptors: Soil water movement, Solutes, Convection, Steady flow, Drainage, Leaching, Flow characteristics, Flow system, Travel time.

A comprehensive theory describing convective transport of solutes was presented in Part I (See W79-06692). In this paper the general theory was applied to specific flow problems. The relatively simple problem of leaching to drains and ditches induced by an input distributed uniformly over the surface was discussed in detail. If the ratio of the halfspacing between the drains or ditches and the depth to the impermeable layer is larger than about five, density distribution is approximately exponential. The general theory was also used to evaluate the literature on many other problems. (Skogerboe-Colorado State)
W79-06693

DETERMINATION OF THE APPARENT DISPERSION COEFFICIENT OF SOLUTES IN UNSATURATED SOIL,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
R. F. Paetzold, and H. D. Scott.
Soil Science Society of America Journal, Vol. 42, No. 6, p 874-877, November-December 1978. 3 fig, 1 tab, 14 ref. OWRT A-039-ARK(1).

Descriptors: *Dispersion, *Solutes, *Soil water movement, Tracers, Laboratory tests, Moisture content, Radioisotopes, Pesticides, Herbicides, Unsaturated flow, Dispersion coefficients.

A method for determining the apparent dispersion coefficient of a solute in unsaturated soils at relatively low soil water flow rates was presented. Two soil cores with different initial water contents were joined, and water was allowed to flow between the soil cores for a specified time interval. The distribution of a radioactively tagged solute, initially present in one of the soil cores, subsequently was determined by freezing the cores in liquid air, sectioning the soil with a refrigerated microtome, and analyzing the soil sections for solute content using liquid scintillation techniques. Apparent dispersion coefficients could be determined either with or against the water flow. The solutes used in this study were tritiated water, chloride, and metribuzin (a herbicide). (Sims-ISWS)
W79-06723

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
For primary bibliographic entry see Field 2F.
W79-06742

WATER AND SALT MOVEMENT IN UNSATURATED FROZEN SOIL: PRINCIPLES AND FIELD OBSERVATIONS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary, R. I. Papendick, and G. S. Campbell.
Soil Science Society of America Journal, Vol. 43, No. 1, p 3-8, January-February 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil temperature, *Infiltration, *Salts, Frost heaving, Heat flow, Mathematical model, Equations, Hydraulic conductivity, Theoretical analysis, Electrical conductance, Percolation, Model studies, Salt movement.

Soil temperatures, electrical conductivities, and water redistribution were measured at 4 field sites during a 30-day period in which the soil was never completely thawed. The soil on each site was a silt loam with varying aspects and vegetation covers. Both upward and downward flows of water and solutes were observed. The assumption that liquid water flow in frozen soil is analogous to unsaturated liquid flow in unfrozen soil, led to a simple equation that, in general, agreed with the field observations. The equation requires knowledge of the soil temperatures, the solute concentrations, and 2 constants that characterize the soil's water release curve and saturated hydraulic conductivity. Infiltration and frost heaving were discussed with respect to this simple theory. Water in frozen soil flows from high to low temperatures and from high to low salt concentrations. Consequently, solutes in eve very low salt soils are important in decreasing frost heave and increasing infiltration. The liquid flow is so closely coupled with temperature that heat flow must be considered simultaneously in any comprehensive analysis. This coupling, as expressed in the simple liquid flow equation, accounts for the effect of soil water content on frost heave rates and the effects of temperature on maximum heaving pressures. (Visocky-ISWS)
W79-06744

AN ATTEMPT AT EXPERIMENTAL VALIDATION OF MACROSCOPIC-SCALE MODELS OF SOIL MOISTURE EXTRACTION BY ROOTS,
Louvain Univ. (Belgium). Lab. of Soil Physics.
C. Belmans, J. Feyen, and D. Hillel.
Soil Science, Vol 127, No 3, p 174-186, March 1979. 12 fig, 33 ref.

Descriptors: *Soil moisture, *Model studies, *Root systems, *Water utilization, Resistance networks, Soil-water-plant relationships, Water table, Absorption, Equations, Hydraulic conductivity, Computer programs, Macroscopic-scale models, Root resistance, Ryegrass.

An experiment was conducted to test the validity of mechanistic simulation model describing the process of soil moisture extraction by root systems, and to assess the quantitative importance of root hydraulic resistance in this process. Close-growing stands of ryegrass were raised in tubes packed with sand and loam, with and without the presence of a water table. The pattern of water uptake was monitored by gamma-ray scanning and tensiometry. Correspondence between measured and independently predicted uptake patterns could be greatly improved by assigning a relatively high value of root resistivity. Further improvement of the mechanistic model's predictive capability may require explicit formulation of conductive (axial) resistance in addition to absorptive (radial) resistance, as well, perhaps, as such important subsidiary factors as aeration, mechanical impedance, and distribution of nutrients in the soil profile. (Visocky-ISWS)
W79-06745

RESULTS OF LYSIMETER TRIALS AT THE LIMBURGERHOF FACILITY 1927-1977; THE MOST IMPORTANT FINDINGS FROM 50 YEARS OF EXPERIMENTS,
Badische Anilin-und Soda Fabrik A.G., Ludwigshafen am Rhein (Germany, F.R.). Landwirtschaftliche Versuchsstation.
S. Jurgens-Gschwind, and J. Jung.
Soil Science, Vol. 127, No. 3, p 146-160, March 1979. 13 fig, 4 tab, 24 ref.

Descriptors: *Lysimeters, *Percolation, *Soil water, *Nutrients, Nitrogen, Phosphorus, Potassium, Magnesium, Crops, Vegetation, Vegetation effects, Leaching, Fertilizers, Agriculture, Rainfall, Soils, Soil science, Laboratories, Data collections, Laboratory tests, *West Germany.

BASF's lysimeter facility at Limburgerhof was 50 years old in 1977. Approximately 130,000 percolate samples from 232 outdoor plots have been removed and measured there to date. About 1.5 million analyses of substances in soil and percolate have been carried out, as have about 190,000 analyses of substances in crops. Thirty-nine publications on the subjects of fertilization and crop protection provide evidence of the comprehensive work in agricultural chemistry, as well as in crop and environmental protection. These publications discuss nutrient supply and nutrient behavior in the soil and their relation to the most varied growing conditions. The speed with which the substances migrate in the soil and their degradation are of special importance when studying the active ingredients of crop protection. The numerous results at Limburgerhof were summarized. (Sims-ISWS)
W79-06746

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
For primary bibliographic entry see Field 2D.
W79-06748

SOIL MOISTURE VARIATION UNDER BARE CONDITIONS AT PUNE AND DELHI IN RELATION TO RAINFALL,
Meteorological Office, Poona (India).
B. C. Biswas.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 555-560, July 1978. 2 fig, 2 tab, 7 ref.

Descriptors: *Soil moisture, *Rainfall, *Variability, Soils, Soil types, Soil water, Precipitation(Atmospheric), Monsoons, Crops, Agronomy, Agriculture, Soil science, Meteorological data, Climatology, *India, *Pune(India), *New Delhi(India).

Soil moisture variation in bare soil of various depths at Pune and Delhi was examined week by week. The study brought out that soil moisture reaches field capacity at Pune on a few occassions and almost every year at Delhi area specially in late monsoon. There may not be any carry over of moisture for the next season at Pune but forced fallows may benefit the succeeding crop at Delhi. (Sims-ISWS)
W79-06750

THE INFLUENCE OF ELECTROLYTE CONCENTRATION ON FLOCCULATION OF CLAY SUSPENSIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. S. Arora, and N. T. Coleman.
Soil Science, Vol. 127, No. 3, p 134-139, March 1979. 1 fig, 5 tab, 20 ref.

Descriptors: *Electrolytes, *Clays, *Flocculation, *Suspension, *California, Dispersion, Clay minerals, Hydraulic conductivity, Alkaline soils, Illite, Kaolinite, Cations, Soils, Sodium adsorption ratio, Concentration.

The influence of mineralogical composition, saturating ions, and electrolyte concentration on the flocculation and dispersion behavior of various clay minerals was used to explain reductions in the hydraulic conductivity observed in many sodic soils containing little or no expandable clay minerals. Sodium-saturated clay minerals were found to differ in their sensitivity to flocculation by NaHCO3 in the decreasing order: illite, vermiculite, smectite, and kaolinite. Critical salt concentrations (CSC) were 185, 58, 28 to 60, and 8 me/liter, respectively, for the above clays. Very low concentrations of CaCl2 or MgCl2, on the order of 1 me/liter or less, were required to flocculate Ca- or Mg-saturated clays. At a sodium adsorption ratio of 15, CSCs were several times greater than those for CaCl2 or MgCl2. A small amount of smectite, possibly deposited on positively charged edges of kaolinite, was responsible for large increases in CSC values of kaolinite. The flocculation behavior of soil clays extracted from 4 California soils was influenced by their mineralogical composition, similar to the patterns observed for reference clay minerals. (Visocky-ISWS)
W79-06761

PERTURBATION SOLUTIONS FOR VERTICAL INFILTRATION PROBLEMS: A UNIFORMLY VALID SOLUTION,
City Coll., New York. Dept. of Mathematics.
D. K. Babu.
Advances in Water Resources, Vol. 1, No. 2, p 111-116, December 1977. 2 fig, 14 ref.

Descriptors: *Soil moisture, *Movement, *Vertical infiltration, *Perturbation, Equations, Iteration methods, Burgers equation, Unsaturated soils.

The high nonlinearities in the parabolic equations governing the movement of moisture in unsaturated homogeneous soils are a complication that is widely known and discussed in the literature. Herein, the problem of vertical infiltration is solved by means of perturbation methods. The structure of the solution exhibits uniform validity for all times and all depths. For comparison between prediction and an exact result, the Burgers equation has been selected. This equation is mildly nonlinear and hence constitutes the most unfavorably known example. (Bell Graf-Cornell)
W79-06925

2H. Lakes

SPECTRAL DISTRIBUTION OF RADIATION IN THE NORTHERN GREAT LAKES DURING WINTER,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. J. Bolsenga.
Journal of Great Lakes Research, Vol 4, No 2, p 226-229, June 1978. 3 fig, 3 tab, 11 ref.

Descriptors: *Radiation, *Solar radiation, *Great Lakes, *Lake Superior, On-site investigations, Instrumentation, Measurement, Clouds, Atmosphere, Water vapor, Energy, Energy transfer, Ice, Melting, Radiation spectra, Spectral distribution.

Measurements of global radiation in the spectral bands 285-2800, 535-2800, 630-2800, and 700-2800 nm were collected at the eastern end of Lake Superior during the period January through May. Significant differences were reported between the various spectral bands on a monthly as well as on a daily and hourly basis, due to varying degrees and types of cloudiness. Values of net and downward radiation for the same period were also provided. (Sims-ISWS)
W79-06596

FACTORS IN THE DETERMINATION OF SELECTED TRACE ELEMENTS IN NEARSHORE U.S. WATERS OF LAKES SUPERIOR AND HURON,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5A.
W79-06597

MODELLING ICE DISSIPATION IN EASTERN LAKE ERIE,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W79-06598

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
D. A. Bahnick, T. P. Markee, C. A. Anderson, and R. K. Roubal.
Journal of Great Lakes Research, Vol 4, No 2, p 186-193, June 1978. 3 fig, 2 tab, 19 ref. EPA R005169-01.

Descriptors: *Lake Superior, *Great Lakes, *Water chemistry, *Sediments, *Erosion, Clays, Sampling, Laboratory tests, Chemicals, Metals, Heavy metals, Dissolved solids, Suspended solids, Analytical techniques, Chemical analysis, Water pollution, Water pollution sources, Lakes, Limnology.

Inputs of chemical parameters were calculated from estimated erosion and resuspension data and by using experimental measurements of chemical releases from both bluff samples and Lake Superior sediments in suspensions with Lake Superior water. The ability of suspended clay particles to remove manganese and copper ions from Lake Superior water was investigated. The loadings of easily leachable dissolved solids, phosphorus, nitrogen, chloride, silica, sodium, potassium, calcium, magnesium, aluminum, and heavy metals from shoreline erosion and resuspended sediment were small compared to Lake Superior tributary inputs. Suspended sediment particles have a large capacity to remove copper and manganese ions from Lake Superior water. Each kilogram of suspended sediment particles of clay size can remove 175 mg of copper and 11 mg of manganese in Lake Superior water spiked to contain 10 microgram/L of each metal. (Sims-ISWS)
W79-06599

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT I DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
For primary bibliographic entry see Field 5A.
W79-06600

STATISTICAL ANALYSIS OF THE 1975 INTERCOMPARISON STUDY ON LAKE ERIE,
Ohio State Univ., Columbus, Dept. of Statistics.
P. I. Feder, and J. E. Zapotosky.
Journal of Great Lakes Research, Vol. 4, No. 2, p 127-133, June 1978. 6 tab, 5 ref. EPA R-802543-01.

Descriptors: *Lake Erie, *Great Lakes, *Sampling, *Laboratory tests, Statistics, Analysis, Chemical analysis, Nutrients, Phosphorus, Nitrogen, Nitrogen compounds, Nitrates, Nitrites, Silicates, Analytical techniques, Laboratories, Lakes, Limnology, Intercomparison studies.

An intercomparison experiment was carried out at two sampling stations on Lake Erie on June 10, 1975, by 3 laboratories that are conducting environmental monitoring programs on the lake. The laboratories simultaneously collected water samples from 3 sampling depths at each station. The samples were divided into thirds, 1/3 to be analyzed by each of the laboratories using their standard procedures. A number of physical, chemical, and biological properties were determined from each of the water samples. One of the principal results of the statistical analyses is that significant differences exist for most of the properties under study, due to which laboratory analyzed the samples. However, the effect due to which laboratory obtained the samples is much less important. These results are in direct agreement with results reported in 1974 by Robertson, Elder, and Davies. (See also W76-11430) (Sims-ISWS)
W79-06601

FACTORS GOVERNING THE BIOLOGICAL PRODUCTIVITY, REGIME, AND CONTENT OF BIOGENIC AND ORGANIC SUBSTANCES IN THE SEQUENCE OF DNEPR RESERVOIRS,
Akademiya Nauk URSR, Kiev. Inst. Hydrobiologii.
For primary bibliographic entry see Field 5B.
W79-06614

DESTRATIFICATION OF LAKES USING BUBBLE COLUMNS,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
C. Kranenburg.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14498, p 333-349, April 1979. 10 fig, 1 tab, 15 ref, 3 append.

Descriptors: *Lakes, *Destratification, *Bubbles, *Model studies, Mathematical models, Mixing, Oxygen, Dissolved oxygen, Water quality, Reservoirs, Stratification, Epilimnion, Hypolimnion, Hydraulics, Limnology, Plumes, Bubble plumes, Air injection, Bubbling pressure.

Mathematical modeling and physical modeling make possible quantitative predictions as regards the destratification process brought about by the local injection of air at the bottom of a thermally stratified lake or reservoir. The mathematical model distinguished between a near field and a far field. Mixing of epilimnion water and hypolimnion water takes place in the near field. The mixing water is accumulated in the far field as an interlayer between epilimnion and hypolimnion. The influence of wind on the mixing is not considered. The agreement between theory and model experiments is satisfactory, but further measurements in nature are needed. Increasing the number of injection points is an effective means to speed up the destratification process. Increasing the air flow rate, however, is not. (Sims-ISWS)
W79-06652

LAKE SURFACE FLUCTUATIONS AND THE MASS FLOW THROUGH THE NARROWS OF LAKE WINNIPEG,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
B. C. Kenney.
Journal of Geophysical Research, Vol. 84, No. C3, p 1225-1235, March 20, 1979. 12 fig, 15 ref.

Descriptors: *Mass transfer, *Canada, *Water levels, *Lakes, Fluctuations, Currents(Water), Current meters, Tides, Flow, Temperature, Water temperature, Winds, Frequency, On-site investigations, On-site data collections, Data processing, Limnology, *Lake Winnipeg(Manitoba).

Lake Winnipeg is a large (23,000 sq km), shallow (12 m), homogeneous lake composed of two well defined basins separated by a central area of irregular geometry that includes the Narrows. Lake current was measured at 3 depths from 2 moorings in the Narrows and was compared with water level records from 7 gauges around the lake throughout the ice free season (May 15-October 15, 1976). The dominant lake response was a forced response produced by natural fluctuations in the wind with periods of 50-100 hours. Large amplitude water level and current fluctuations were produced by low wind speeds due to resonance caused by wind periodicity near the 39 hour natural co-basin oscillation of the lake. Although damping is subcritical, allowing for a resonant response, Lake Winnipeg is heavily damped compared to deep lakes. The co-basin oscillation is so low in frequency that a classical wind setup is unlikely to occur. Free oscillations were of secondary importance to the large-scale dynamicsj of the lake. Several shole lake modes higher than the first were identified from the current and water level records, but the amplitudes of these modes were very small compared to the free response of the Great Lakes. There was also a detectable response in the records at several natural frequencies of the individual basins and at the M sub 2 tide. (Sims-ISWS)
W79-06755

LOW-FREQUENCY CURRENT FLUCTUATIONS IN LAKE ONTARIO, WINTER 1972-1973 (IFYGL),
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
G. O. Marmorino.
Journal of Geophysical Research, Vol. 84, No. C3, p 1206-1214, March 20, 1979. 11 fig, 2 tab, 21 ref. NOAA 04-6-022-44026.

Descriptors: *Great Lakes, *Lake Ontario, *Currents(Water), On-site investigations, On-site data collections, Data processing, Lakes, Winter, Winds, Fluctuations, Variability, Temperature, Water temperature, Circulation, Water circulation, Limnology.

An analysis was presented of thelow-frequency (omega less than 0.6 cycles per day) current fluctuations in Lake Ontario, using measurements made at 15 and 75 m during the 1972-1973 winter. The data, collected as part of the International Field Year for the Great Lakes (IFYGL), were obtained at 9 stations: 1 near midlake and the other 8 spaced around the lake, about 50 km apart and 12 km from shore. Let U denote the alongshore velocity (positive leaving the shore to the right) and V the cross-shore velocity (positive offshore). It was found that (1) the standard deviation of V is approximately constant; (2) the standard deviation of U, which is about 2.4 times greater than that of V, may be depth independent and is less at the southern shore stations than at the shallower northern stations where the flow appears to be directly wind driven; (3) the velocity fluctuations are roughly aligned with the local orientation of the coastline; (4) the U fluctuations show much better mutual correlation than the V fluctuations, having an alongshore coherence length of about 250 km (nearly half the basin perimeter); (5) the U signal shows high coherence for periods of about 10-25 and 4-5 days; and (6) the computation of lagged correlations shows the U fluctuations to propagate in a counterclockwise sense from the northern shore at a rate of about 42 km/d(0.5 m/s), which implies a period of about 13 days for a complete circuit around the lake. These results provided additional evidence for the existence of topographic Rossby waves (shelf waves) in Lake Ontario, the calculated period being consistent with results of previous studies which used data from the summer and fall of 1972. (Sims-ISWS)
W79-06756

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 2E.
W79-06758

ICE GROWTH STUDIES IN DULUTH-SUPERIOR HARBOR 1974-75,
Minnesota Univ. -Duluth.
For primary bibliographic entry see Field 2C.
W79-06763

SUPERCRITICAL WITHDRAWAL FROM TWO-LAYERED FLUID SYSTEMS, PART 1: TWO-DIMENSIONAL SKIMMER WALL,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
G. H. Jirka.
Journal of Hydraulic Research, Vol 17, No 1, p 43-51, 1979. 4 fig, 11 ref.

Descriptors: *Stratified flow, *Model studies, *Intakes, *Flow control, Mathematical models, Analytical techniques, Theoretical analysis, Analysis, Weirs, Laboratory tests, Supercritical flow, Hydraulic structures, Intakes structures, Reservoirs, *Skimmer wall, *Selective withdrawal, Two-dimensional flow, Two-layer flow.

An analysis of the selective withdrawal features of a two-dimensional skimmer wall was developed based on the concept of a double critical flow section in the two-layered stratified fluid system. The theory predicts the withdrawal ratio as a function of two governing parameters, a densimetric Froude number and a layer depth ratio. The skimmer wall design condition of incipient withdrawal as derived by Harleman and Elder (1965) is included as a special case. Good qualitative agreement with available experimental data is found. An 'effectiveness' diagram displaying the fully effective, partially effective and non-effective regimes of skimmer wall operation was developed. (See also W79-06767) (Humphreys-ISWS)
W79-06766

SUPERCRITICAL WITHDRAWAL FROM TWO-LAYERED FLUID SYSTEMS, PART 2: THREE-DIMENSIONAL FLOW INTO ROUND INTAKE,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
G. H. Jirka, and D. S. Katavola.
Journal of Hydraulic Research, Vol 17, No 1, p 53-62, 1979. 8 fig, 1 tab, 5 ref.

Descriptors: *Stratified flow, *Intakes, *Flow control, *Model studies, Hydraulic structures, Intakes structures, Laboratory tests, Hydraulic models, Analytical techniques, Analysis, Dimensional analysis, Supercritical flow, Conduits, Reservoirs, *Round intake, *Selective withdrawal, Three-dimensional flow, Two-layer flow.

An experimental study was made of the selective withdrawal characteristics of a round horizontal axis pipe intake located in a vertical wall. The ambient fluid system has a two-layer stratification with a diffuse interface. The results for incipient withdrawal indicate considerably lower critical Froude numbers than that obtained by earlier studies by Craya (1949) and Gariel (1949). Geometry effects due to the intake diameter and the pycnocline thickness appear to cause this discrepancy. The supercritical withdrawal ratio from both fluid layers exhibits a unique dependence on the densimetric Froude number normalized by its critical

alue. The withdrawal characteristics in the super-ritical range, with simultaneous withdrawal from oth layers, can be represented by a unique empiri-al curve independent of geometric effects. (See lso W79-06766) (Humphreys-ISWS)
V79-06767

OPERATORS PRESENT TESTIMONY IN DE-FENSE OF PLAYA LAKE DISPOSAL,
For primary bibliographic entry see Field 5C.
W79-06808

HYDROLOGY OF LAKES IN THE MINNE-APOLIS-SAINT PAUL METROPOLITAN AREA: A SUMMARY OF AVAILABLE DATA STORED--USING A DATA-BASE MANAGE-MENT SYSTEM,
Geological Survey, St. Paul, MN. Water Re-ources Div.
M. S. McBride.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 413, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 76-85, September 1976. 317 p, 2 fig, 8 tab, 7 ref.

Descriptors: *Lakes, *Limnology, *Hydrology, *Lake morphometry, *Data storage and retrieval, Hydrologic data, Inflow, Discharge(Water), Water evels, Ecology, Geomorphology, Data process-ng, Urban hydrology, *Minneapolis-St Paul met-ropolitan area, *System 2000, Level B studies.

Data were collected and summarized on the hydrology and hydrogeology of 949 lakes, 10 acres or larger, in the Minneapolis-St. Paul metropolitan area, Minnesota. Eight tables totaling over 100 pages present data on location, depth, area, lake level, ecological and game-management classification, inflowing and outflowing streams, soils, bedrock type, water added to or taken from lake, and reported lake-related problems. SYSTEM 2000, a generalized computer data-base management system, was used to organize the data and prepare the tables. SYSTEM 2000 provides powerful capabilities for future retrieval and analysis of the data. The data base is available to potential users so that questions not implicitly anticipated in the preparation of the published tables can be answered readily, and the user can retrieve data in tabular or other forms to meet his particular needs. (Woodard-USGS)
W79-06815

DISSOLVED-SOLIDS BUDGET OF LAKE OKEECHOBEE, FLORIDA, OCTOBER 1964 TO SEPTEMBER 1974,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. V. Maddy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 028, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-97, 1978. 36 p, 3 fig, 14 tab, 22 ref.

Descriptors: *Hydrologic budget, *Dissolved solids, *Lakes, *Inflow, *Discharge(Water), Rainfall, Evaporation, Regression analysis, Water quality, Florida, *Lake Okeechobee.

Lake Okeechobee is a major surface-water storage facility for south Florida. A dissolved-solids budget for Lake Okeechobee was computed for Oct. 1964 to Sept. 1974, a 10-year budget period. Calculations were based on records of daily discharge, daily specific conductance measurements, and regression equations relating dissolved-solids concentrations and specific conductance. The lake received more than 13 million acre-feet of rainfall during the budget period and lost more than 18 million acre-feet of water to evaporation. Lake Okeechobee received more than 20 million acre-feet of inflow and released almost 16 million acre-feet to distributaries. A water budget of 34.48 million acre-feet for the 10-year budget period was computed. Rainfall produced an input of 460,000 tons of dissolved solids to Lake Okeechobee. Inflow from tributaries and distributaries added 5.51 million tons of dissolved solids to the lake and outflow to distributaries removed 6.71 million tons. A dissolved-solids budget of 6.99 million tons for the 10-year budget period was computed. (Woodard-USGS)
W79-06817

PRELIMINARY WATER-QUALITY CHARACTERIZATION OF LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 100, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-94, 1978. 31 p, 5 tab, 25 ref. append.

Descriptors: *Washington, *Lakes, *Chemical properties, *Physical properties, *Analytical techniques, Water analysis, Chlorophyll, Evaluation, Planning, Lake restoration.

A method is described for comparing and characterizing lakes in Washington on the basis of water quality. The method can aid in selecting lakes for lake-restoration efforts. To simplify comparisons, a characteristic value (CV) was developed for each of 617 lakes in Washington using principal-component analysis. Three of 14 water-quality properties measured were used in this analysis because the principal component of the three properties accounted for 63 percent of the variance in the correlation matrix. The three properties were Secchi-disc visibility and concentrations of phosphorus and organic nitrogen. The significance of the derived CV's was evaluated by regression of chlorophyll a concentration against CV. The resulting standard error of estimate of + or - 1.8 micrograms per liter of chlorophyll a indicated that the CV can be a useful index in assessing relative water-quality and trophic conditions among lakes. (Woodard-USGS)
W79-06824

SEASONAL SUCCESSION OF PHYTOPLANKTON IN ROOSEVELT LAKE, ARIZONA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
R. Cisneros, R. D. Olsen, and M. R. Sommerfeld.
Journal of the Arizona-Nevada Academy of Science, Vol. 14, No. 1, p 7-12, Feb. 1979, 2 fig, 1 tab, 26 ref.

Descriptors: *Phytoplankton, *Marine algae, *Succession, *Biological communities, *Lake morphometry, *Seasonal, Aquatic life, Diatoms, Euphotic zone, Chlorophyta, Cyanophyta, Algae, Aquatic algae, Arizona, Roosevelt Lake.

Although there have been several recent investigations on the phytoplankton of Arizona lakes, data on the abundance of phytoplankton and their seasonal dynamics in southwestern lakes remain relatively sparse. The present study was performed to determine the composition and seasonal pattern of phytoplankton succession in Roosevelt Lake, 126 km ENE of Phoenix in Gila County, Arizona, from February 1971 through August 1974. Four sampling sites were established to represent differences in reservoir morphometry, and phytoplankton were collected from the surface 2, 5, 10 and 20 M although the data presented here is primarily from the 2 M samples collected from February 1971 through February 1972. Site selections, depths and time periods were chosen to be generally representative of species richness, abundance and succession in the euphotic zone of Roosevelt Lake. Results indicated that 109 species of algae occurred annually in the plankton of this lake, the majority of which were the species Chlorophycean and Bacillariophycean. Community size was found to be relatively constant throughout the year although a noticeable succession of algal classes and species occurred in which blue green algae was summer dominant and diatoms dominated the winter flora. Algal flora was found to be primarily temperate in nature with some tropical tendencies. (Tickes-Arizona)
W79-06845

A GENERAL CIRCULATION MODEL FOR LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. C. K. Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 834, Price codes: A03 in paper copy, A01 in microfiche. Report No. NOAA Technical Memorandum ERL GLERL-16, August 1977. 46 p, 12 fig, 1 tab, 30 ref, 1 append.

Descriptors: *Lakes, *Model studies, *Circulation, *Equations, *Water circulation, *Lake morphology, Lake morphometry, Bathymetry, Surface waters, Wind pressure, Meteorology, Currents(Water), Density currents, Movement, Lake breezes, Lake Ontario, Research and development, Thermocline, Boundary layers, Air-water interfaces, Water temperature.

The lake circulation model developed is based on primitive equations relative to a geographic coordinate system on the surface of the earth, and takes all major physical processes into account, including the nonlinear effects and the horizontal effects, with a rigid lip approximation for computational efficiency. It simulates the organized water motion and temperature structure throughout the annual cycle to enable the physical nature of the lake to be understood in response to atmospheric forcing. Fresh water density is approximated as a quadratic function of temperature. Imposed meteorological conditions drive lake circulation. Test runs were made using the geometry and bathymetry of Lake Ontario on a 5-km grid with four vertical layers. Two cases where surface winds and heat are similar to the average conditions of July and November show that the total lake response is dominantly barotropic and gradually become baroclinic. Wind pattern, surface current, and flow pattern data are discussed. That the simulated current pattern did not totally agree with the International Field Year for the Great Lakes data may be due to the coarse grid separations in the horizontal and vertical directions without proper resolution of the boundary layers and the thermocline. It is expected that the errors involved with stresses and heating will be reduced when time-dependent, seasonal variation runs are made. (Davison-IPA)
W79-06871

PROCEEDINGS: LAKE MANAGEMENT CONFERENCE, JUNE 9, 1977, UNIVERSITY OF CONNECTICUT, STORRS.
Connecticut Univ., Storrs. Inst. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 093, Price codes: A07 in paper copy, A01 in microfiche. Report No. 30, March 1979. 130 p, 28 fig, 19 tab, 48 ref. OWRT A-999-CONN(18). OWRT 14-34-0001-9007.

Descriptors: *Lakes, *Eutrophication, Phosphorus, Land use, Groundwater, Lake management, Connecticut lakes, Nutrient budgets.

Eight technical papers on various aspects of lake management were presented at the Lake Management Conference held at the University of Connecticut in 1977. The results of research on the various suspected causes of lake eutrophication, the relationship of land use to lake water quality, the ongoing lake management strategies and the plans suggested for future approaches were explained. The effectiveness of various eutrophication control methods were discussed and the costs to be expected for the use of these methods were given. Emphasis was placed on the management of Connecticut lakes, although studies on lakes throughout the state and the nation were also mentioned. Two major benefits of the conference were the presenting of new technical information on lake management strategies by the speakers and the opportunity of participants to meet people who have some of the information and background in managing lakes. (de Lara-Conn)
W79-06893

ESTIMATION OF WATER SURFACE ELEVATION PROBABILITIES AND ASSOCIATED DAMAGES FOR THE GREAT SALT LAKE,
Utah Water Research Lab., Logan.
L. D. James, D. S. Bowles, W. R. James, and R. V. Canfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 056, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-79/03, March 1979. 182 p, 6 append, 25 fig, 63 tab. OWRT B-153-UTAH(2). 14-34-0001-8122.

Descriptors: Flood estimate, Frequency analysis, *Lake stages, Stochastic models, Synthetic hydrology, Lakes, *Water levels, Great Salt Lake, Terminal lakes.

Rising water surface elevations in perennial terminal lakes threaten major damages to shoreline industrial plants, transportation routes, and wetlands. Falling elevations increase pumping costs for industries extracting minerals from the lake water and reduce the quality of shoreline recreation. The managers of these properties need information on future lake level probabilities for planning, and public agencies need information on both probabilities and damages to determine whether lake level control is justified. Methods of operational hydrology were used to simulate lake level and shoreline damage sequences for the Great Salt Lake. Both ARMA (1,0) and ARMA (1,1) models were tried in generating multivariate sequences of precipitation, evaporation, and three river flows for 1937-1977. The multivariate Markov model was the only one able to preserve historical sequences, but recommendations for improved parameter solution techniques for the ARMA (1,1) model are made to help future users take better advantage of its theoretically greater ability to preserve hydrologic persistence. The model developed with the capability of estimating low future lake level probabilities would be affected by upstream water development and by pumping water from the lake during high stages into the western desert. Data on damages to 21 cost centers were collected, and a damage simulation model was developed to use them to estimate average annual damages under current conditions and benefits from lake level control efforts. Average annual damages to the mineral industry, railroads, highways, wetlands, and other properties were estimated to be currently $1,550,000.
W79-06894

ON PRESSURE-WORK, VISCOUS DISSIPATION AND THE ENERGY BALANCE RELATION FOR GEOTHERMAL RESERVOIRS,
Systems, Science and Software, La Jolla, CA.
S. K. Garg, and J. W. Pritchett.
Advances in Water Resources, Vol. 1, No. 1, p 41-47, September 1977. 2 tab, 11 ref.

Descriptors: *Geothermal studies, *Reservoirs, *Pressure-work, *Viscous dissipation, *Energy, *Balance laws, Flow, Effects, Temperature, Computers, Simulation analysis, Equations, Numerical solutions, Mass, Momentum.

This article examines the conditions under which the pressure-work and viscous dissipation terms should be retained in the energy balance relation for single (liquid water or vapor) and two-phase (liquid water and vapor) fluid flow through porous media. It is shown that if one wishes to retain the pressure-work term, then one must also keep the viscous dissipation term in the energy balance. Consideration of steady non-isothermal radial flow demonstrates that both pressure-work and viscous dissipation are liable to have negligibly small effects in single phase liquid water and in two-phase liquid-vapor systems. This conclusion is, however, not generally valid for pure vapor systems; in this case, pressure-work and viscous dissipation can produce significant variations in the computed reservoir response. (Bell Graf-Cornell)
W79-06924

OPERATIONAL EFFECTS OF IRRIGATION AND PUMPED STORAGE ON THE ECOLOGY OF BANKS LAKE, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober, R. W. Tyler, J. A. Knutzen, D. Gaudet, and C. E. Petrosky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 790, Price codes: A08 in paper copy, A01 in microfiche. Final Report No. REC-ERC-77-5, December 1977. 165 p, 100 fig, 27 tab, 71 ref, 1 append. 14-06-100-7794.

Descriptors: *Ecology, *Fish, *Fish populations, *Fish management, *Pumped storage, *Limnology, *Powerplants, Drawdown, Environmental effects, Lake morphology, Nutrients, Reservoirs, Fish reproduction, Sport fish, Phytoplankton, Zooplankton, Columbia Basin Project, Banks Lake, Franklin D. Roosevelt Lake(Washington).

The physical, chemical and biological changes in Banks Lake, Washington, resulting from pumping/generating operations are discussed. Banks Lake functions as the reregulating reservoir for the Columbia Basin irrigation project. Results of the following studies are reported: limnology of the lake, fish populations monitoring, kokanee fry study, 1975-76 sport fishery, and fish entrainment through the irrigation and feeder canals. The north pool of this two pool system is directly influenced by the pumped input of water from FDR Reservoir. This pumped inflow maintained warmer temperatures in the winter and cooler temperatures in the summer in the north pool relative to the south pool. The north pool showed thorough mixing of the water column, greater concentrations of the plant nutrients, nitrates and phosphates, and greater phytoplankton production than found in the south pool. Zooplankton developed in the south pool. Of the 22 species of fish identified in the lake 90% were yellow perch, lake whitefish, and kokanee. In general the three major species avoided the north pool. Drawdown of the lake in 1973 and 1974 resulting from powerplant construction at Grand Coulee Dam reduced the reproduction of the yellow perch and kokanee. Fish loss due to entrainment occurred mainly through the irrigation canal; fish entrainment through the feeder canal was relatively minor. It is concluded that nutrient addition and mixing are beneficial, but water level fluctuations, entrainment and flushing limit production and maintenance of aquatic life. (Davison-IPA)
W79-06942

2I. Water In Plants

SEASONAL WATER USE BY WINTER WHEAT GROWN UNDER SHALLOW WATER TABLE CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
For primary bibliographic entry see Field 2G.
W79-06691

LEAF OSMOTIC POTENTIAL AS AN INDICATOR OF CROP WATER DEFICIT AND IRRIGATION NEED IN RAPESEED (BRASSICA NAPUS L.),
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
J. M. Clarke, and G. M. Simpson.
Agricultural Water Management, Vol 1, No 4, p 351-356, December, 1978. 2 fig, 3 tab, 8 ref.

Descriptors: Moisture deficit, *Moisture content, Water requirements, Moisture stress, Moisture tension, Leaves, Tensiometers, *Osmotic pressure, Crop production.

Leaf osmotic potentials (LOP) of field-grown rapeseed (Brassica napus L.) were measured in 1975 and 1976 under rainfed conditions and at two levels of irrigation. Irrigations were scheduled on the basis of tensiometer measurements in 1975, and on the basis of LOP in 1976. The LOP of rainfed plants was lower (more negative) than that of irrigated plants. Leaf osmotic potential responded to changes in soil moisture caused by precipitation or irrigation. Tensiometers placed at 0.2 m depth in the high irrigation treatment were as responsive to soil moisture changes as LOP. Scheduling of irrigations on the basis of LOP in 1976 produced yield differences between water regimes similar to those obtained in 1975. It was concluded that leaf osmotic potential provides a satisfactory means for determining need for irrigation in B. napus. (Skogerboe-Colorado State)
W79-06708

SOYBEAN CROP WATER REQUIREMENTS,
Regional Center of Agricultural Research, Crida (Spain). Dept. of Cereals and Legumes.
J. Dominquez, M. Horta, and E. Robledo.
ICID Bulletin (International Commission on Irrigation and Drainage), Vol. 27, No. 2, p 30-35, July, 1978. 3 fig, 22 ref.

Descriptors: Soil-water-plant relationships, *Water requirements, *Soybeans, Moisture deficit, Moisture stress, Growth stages, Evapotranspiration, Yield equations, Crop production.

In experiments carried out in the three-year period 1974-1976, in 'Finca El Encin', CRIDA, Alcala de Henares, on soybean crops irrigated by sprinklers, Amsoy variety, a very high correlation between the RET (Real Evapotranspiration) in the flowering and pod formation period and the final grain production was found. This suggested, on the one hand, subjecting the plant to an initial deficit to adequately develop the root system and on the other, supplying quantities of about 9 mm during The said period, which should increase the production level to 4,000 kg/hectare. Penman's modified formula for daily application, following the guidelines of the Irrigation Management Service, proved to be inadequate in the sense that it provided low ETP values. A greater consideration of the aerodynamic term was suggested by the influence that the advective effect has on irrigation areas with arid climate. For practical experiments the scheme based on the utilization of the distribution curves of a water sprinkler, was satisfactory, leading to a more reliable analysis, and to a simplification of the experimental procedure. (Skogerboe-Colorado State)
W79-06712

WATER BALANCE OF FLOODED RICE PADDIES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, F. T. Turner, J. C. Thomas, L. E. Deuel, and M. E. Keener.
Agricultural Water Management, Vol. 1, No. 3, p 277-291, November, 1978. 10 fig, 3 tab, 8 ref.

Descriptors: *Water balance, Submerged plants, *Flood irrigation, *Rice, Evapotranspiration, Runoff.

Rice (Oryza sativa L., var. Labelle) was grown in 300 m 2 paddies of Beaumont clay soil (Typic pelludert) and subjected to two management schemes of flooded rice culture. These schemes were continuous irrigation and intermittent irrigation. Careful measurements of irrigation, precipitation, evapotranspiration, deep percolation and runoff were made, and the total water balance for the two water management schemes was calculated. The results showed continuous irrigation to be very wasteful of water with slightly over 1 m of irrigation water applied to supply an evapotranspirational need of 0.5-0.6 m. The intermittent irrigation management was less wasteful but still could be improved upon. Suggestions were presented for techniques to help improve the water use efficiency and reduce runoff losses. (Skogerboe-Colorado State)
W79-06713

GRAPEFRUIT RESPONSE TO VARIABLE SALINITY IN IRRIGATION WATER AND SOIL,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
H. Bielorai, J. Shalhevet, and Y. Levy.
Irrigation Science, Vol. 1, p 61-70, 1978, 3 fig, 4 tab, 16 ref.

Descriptors: *Grapefruit, *Saline water, *Crop response, *Irrigation water, *Soil-water-plant relationships, Water quality, Soil chemical properties, Salt tolerance, Irrigation effects, Consumptive use, Citrus fruits, Israel.

Increasing salinity in irrigation water throughout the arid-semiarid world is a matter of growing concern in regions where irrigated crops such as citrus are vital to export economies. The field experiment described in this paper was conducted in the northern Negev Desert region of Israel during 1973-1976 where a control orchard was subjected to 8 varying concentrations of sodium chloride and calcium chloride injected into the sprinkler irrigation system. Soil water content was measured before and after each irrigation at intervals .3m to a depth of 1.8m with a neutron probe. Irrigation efficiency for each irrigation was determined by the difference between pre-and post-irrigation soil water content. Results indicate that total water uptake was reduced as salt concentration in the soil increased, and yield was linearly related to the mean chloride concentration in the soil saturation extract. Salt accumulation in the soil was found to be dependent on the quantity and salt concentration of the irrigation water, rainfall, and the amount of leaching. No leaf injury was observed. It is concluded that the effect of salinity on grapefruit yield is osmotic rather than the result of a specific ion. (Tickes-Arizona)
W79-06841

SEASONAL SUCCESSION OF PHYTOPLANKTON IN ROOSEVELT LAKE, ARIZONA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 2H.
W79-06845

CORN PRODUCTION AS INFLUENCED BY IRRIGATION AND SALINITY - UTAH STUDIES,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
R. J. Hanks, G. L. Ashcroft, V. P. Rasmussen, and G. D. Wilson.
Irrigation Science, Vol. 1, p 47-59, 1978. 9 fig, 3 tab, 8 ref. OWRT B-121-UTAH(3) and C-5189(4233)(4).

Descriptors: *Crop response, *Salty tolerance, *Corn, *Irrigation effects, *Soil-water-plant relationships, *Evapotranspiration, Consumptive use, Plant growth, Saline water, Saline soil, Water quality, Sprinkler irrigation.

Described here are the Utah results of a wider study carried out in Arizona, California, Colorado, and Utah, 1974-1975, to develop a predictive model of the several site-specific irrigation and salinity effects on corn production. Trials conducted at Utah State University's Greenville Farm on silt loam soil evaluated the influence of differing amounts and timing of saline irrigation water. Using trickle irrigation, treatments were applied uniformly at all water levels. Results indicated that corn grain and total dry matter production were linearly related to evapotranspiration, regardless of the irrigation or salinity regimes. Soil pre-salinization decreased yields in proportion to the salinity imposed. The decrease was associated with reductions in evapotranspiration caused by reduced soil water depletion, as compared with the non-salinized treatments. (Tickes-Arizona)
W79-06860

2J. Erosion and Sedimentation

SEDIMENT SIZES ERODED FROM ROW-CROP SIDESLOPES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. D. Meyer, W. C. Harmon, and L. L. McDowell.
Paper No 78-2518, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978 Chicago, Illinois. 9 p. 7 fig, 4 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: Sediments, *Sediment distribution, Simulated rainfall, *Soil erosion, Rainfall intensity, Canopy.

Row sideslopes of ten soils were studied under simulated rainstorms to determine the size distributions of their eroded (undispersed) sediment. The eroded sediment sizes for different soils differed considerably. These distributions were compared to the size distributions of the dispersed sediment and original surface soil. The undispersed sediment was coarser than the dispersed soil or sediment, much coarser for many soils. For each soil, the sediment size distribution changed relatively little with major changes in rain intensity, continued erosion, and crop canopy. (Skogerboe-Colorado State)
W79-06547

EVALUATION OF GRASS CHARACTERISTICS RELATED TO SEDIMENT FILTRATION,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. C. Hayes, B. J. Barfield, and R. I. Barnhisel.
Paper No. 78-2513, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 21 p, 7 fig, 2 tab, 10 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment transport, Sediment control, Filtration, *Grasses, Vegetation effects, Sediment yield, Regression analysis, Roughness coefficient, Watershed management.

Vegetal filtration was proposed as a means of reducing sediment from disturbed areas. Recent studies using simulated media have led to relationships which define deposition within a grass filter. Several characteristic dimensions were required to define the effects of vegetation on flow and sediment transport. Quantification of these dimensions, sensitivity of the relations to errors in measurement, and further verification data were included. (Skogerboe-Colorado State)
W79-06549

FARM LEVEL ECONOMIC EVALUATION OF EROSION CONTROL,
Iowa State Univ., Ames.
J. M. McGrann.
Paper No. 78-2515, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 13 p. 2 fig, 3 tab, 15 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Erosion control, Soil erosion, Cost comparisons, Soil management, Economic impact, *Contour farming.

Farm level economic evaluation of erosion control alternatives in three major soil associations in Iowa indicated that: (1) residue tillage and contouring is the most cost effective alternative to reduce soil erosion, (2) the economic impact of reducing soil loss is less on mixed crop and livestock farms than specialized crop farms, and (3) although the economic impact of erosion control differs between soil areas, reduction of soil loss below the 5 ton level can be accomplished through conservation tillage in large areas of Iowa with little reduction in farm income without public participation in farm level costs. (Skogerboe-Colorado State)
W79-06550

EROSION INVENTORY-SHEET AND RILL EROSION,
Soil Conservation Service, Washington, DC.
R. I. Dideriksen, and A. R. Hidlebaugh.
Paper No. 78-2514, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 33 p, 3 fig, 14 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Soil erosion, *Rill erosion, Sheet erosion, Wind erosion, Erosion control, Data collections, Conservation.

Erosion by wind and water from farmland remains a serious problem in the United States. This inventory takes a new look at the problem and provides current information on natural and related resources on nonfederal land for all states except Alaska. Nearly one quarter million randomly selected sample sites were observed in the field and farm owners and operators were interviewed. The data gathered in 1977 were used in the Universal Soil Loss and Wind Erosion models to estimate the rate and amount of sheet, rill, and wind erosion for different soils, land uses, and management systems. (Skogerboe-Colorado State)
W79-06551

NITROGEN AND PHOSPHORUS LOSSES IN RUNOFF FROM NO-TILL SOYBEANS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5G.
W79-06552

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W79-06599

INVESTIGATION OF THE PROBABILISTIC REGULARITIES OF SALTATION OF SOLID PARTICLES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
N. N. Grishin.
Water Resources, Vol. 4, No. 6, p 941-947, November-December 1977. 4 fig, 20 ref. Translated from Vodnye Resursy, No. 6, p 174-181, November-December 1977.

Descriptors: *Saltation, *Sediment transport, *Suspended solids, *Sediments, *Model studies, Mathematical models, Erosion, Turbulent flow, Velocity, Turbidity, Movement, Sedimentology.

The movement of solid particles in turbulent air or water flows has, as a rule, a leap-like character. The existing theories of the bounding movement of sediments are usually based on the assumption of the absence of interaction between particles, i.e., the content of sediments in a unit volume of the medium transporting them is assumed to be sufficiently small. However, in many problems the need arises to examine the mass movement of sediments. The particles saltating near the bottom form turbidity there; the magnitude of the near-bottom turbidity is usually taken as a boundary condition of the diffusion equation, by means of which the distribution of suspended sediments in open flows for not very large concentrations and sufficiently small sizes of the particles is generally described. In connection with this, it is of interest to study the problem of the permissible concentrations of saltating particles for which the regularities obtained for the case of movement of single particles are still valid. Examining the mass movement of particles, we must take into account both the collision of particles and their effect on kinematics of the flow. In this article, the kinematics of the particles themselves, the average velocity relative to their movement, were examined. By means of this examination the probability of collision of the particles was estimated. Therefore, the values of the concentrations of saltating sediments corresponding to the upper limit of applicability of the aforementioned concept of noninteraction between particles can be obtained. (Sims-ISWS)
W79-06610

FLOW PAST BODIES IN A TURBULENT FLOW NEAR A SOLID SURFACE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
K. I. Rossinskii, and K. M. Arbulieva.

Water Resources, Vol. 4, No. 6, p 926-935, November-December 1977. 9 fig, 10 ref. Translated from Vodnye Resursy, No. 6, p 156-167, November-December 1977.

Descriptors: *Turbulent flow, *Boundary layers, *Bottom sediments, Suspended solids, Model studies, Mathematical models, Flow, Hydraulics, Reynolds number, Boundaries(Surfaces), Fluid mechanics, Sedimentation, Erosion, Sedimentology, Flow past bodies.

If a turbulent flow is underlain by soil consisting of individual particles not cohering to one another, then at sufficient current velocities of the water individual soil particles are detached from the bottom by the flow and either perform leaps near the bottom or are entrained into the flow and move in a suspended state. Detachment of the particles occurs as a result of the hydrodynamic action of the flow. The nature of this action is still the subject of debate. During interaction of a moving fluid and a solid body located in it which has a symmetrical form relative to the direction of the average current (sphere, cylinder with an axis normal to the current, etc.) in an unconfined flow, as is known, does not occur, since the pressures developing on the upper and lower surfaces of such a body are the same on both sides and cause only tensile stresses within the body. The effect of a wall on the force developing during flow past a body has been studied by a number of investigators and at present interesting data have been accumulated which permit judging the character of the phenomenon. The results of such investigations were presented, and one of the possible explanations of the nature of the lift detaching solid particles from the bed of a turbulent flow was given. (Sims-ISWS)
W79-06612

INPUT-OUTPUT MODEL FOR RUNOFF-SEDIMENT YIELD PROCESSES,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
T. C. Sharma, W. G. S. Hines, and W. T. Dickinson.
Journal of Hydrology, Vol. 40, No. 3/4, p 299-322, February 1979. 6 fig, 12 tab, 13 ref.

Descriptors: *Sediment yield, *Model studies, *Runoff, Watersheds(Basins), Statistical methods, Statistical models, Hydrology, Equations, Mathematical models, Stochastic processes, Analysis, Monthly, *Watershed fluvial system, Parsimonious models, Input-output models.

Runoff (log-transformed) and sediment yield (log-transformed) sequences on a monthly or daily basis can be regarded as input and output for the watershed fluvial system. These sequences are nonstationary, in general, in different hydrological environments. Frequency and time domain analyses have shown that a parsimonious model can be built directly in terms of these nonstationary input-output sequences on a monthly and daily basis. A first-order dynamic model was found adequate to model the monthly runoff-sediment yield process; a second-order model adequately modeled the daily runoff-sediment yield process. The noise component in both cases possessed the characteristics of a white-noise sequence. (Lee-ISWS)
W79-06617

ESTIMATING SEDIMENT TRANSPORT IN A BRAIDED GRAVEL CHANNEL--THE KAWERONG RIVER, BOUGAINVILLE, PAPUA NEW GUINEA,
Papua and New Guinea Univ., Port Moresby (New Guinea).
G. Pickup, and R. J. Higgins.
Journal of Hydrology, Vol. 40, No. 3/4, p 283-297, February 1979. 8 fig, 1 tab, 17 ref.

Descriptors: *Sediment transport, *Channels, *Braiding, Monte Carlo method, Sedimentation, Sediments, Streams, Hydraulics, Equations, Rivers, *White River, *Papua New Guinea, *Bougainville Island(Papua New Guinea), *Braided channel, *Kawerong River(Papua New Guinea), Braided streams.

It is difficult to estimate sediment transport in braided rivers because of the complex hydraulics of rapidly changing multi-channel systems. This paper described an algorithm for generating sets of braided-river hydraulic parameters for use with sediment transport equations. The algorithm used random number-based simulation techniques and empirically determined probability distributions of individual hydraulic variables from the White River (U.S.A.) and the Kawerong River. A test of the suitability of the algorithm for the estimation of sediment transport was carried out over a period of two years using the Meyer-Peter and Muller equation on 8 reaches of the Kawerong River in which sediment transport is known. The test produced a mean absolute error of 16.3%, suggesting that the algorithm may have some potential in braided-river modelling. (Lee-ISWS)
W79-06618

THE INTRUSION OF FINE SEDIMENTS INTO A STABLE GRAVEL BED,
Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta, and W. L. Jackson.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 204-210, February 1979. 5 fig, 1 tab, 18 ref.

Descriptors: *Streambeds, *Laboratory tests, *Hydraulic models, *Sedimentation, Sediment transport, River beds, Gravels, Silting, Deposition(Sediments), Model studies, Sands, Bed load, Particle size, Hydraulics, Flow, Data collections, Methodology, Flow characteristics, Movement, Analysis, Riffles, Substrates.

A rectangular flume was used to study variables affecting the intrusion of fine sands into a stable gravel streambed. The amount of intrusion by sand (median particle diameter 0.5 mm) was determined under varied conditions of discharge, depth, velocity, flume slope, and rates of sediment transport. During all experimental tests, sand particles were trapped in voids within the upper 10 cm of an initially clean gravel bed (median particle diameter 15 mm), forming a barrier to further intrusion. An analysis of flow variables showed that flow conditions, as indexed by Froude number, significantly (90% confidence level) affected intrusion amounts, possibly by influencing the rate and depth of formation of the sand seal. Intrusion amounts, expressed as a percent of total volume, varied from 2 to 8%. Two replications used a finer grade sand (median particle diameter 0.2 mm) that intruded more and, in one case, completely filled the gravel pore space (25% by volume), further indicating that particle size, and not hydraulic variables, may have a more important influence on the total amount of intrusion. (Humphreys-ISWS)
W79-06643

KAOLINITE RESUSPENSION PROPERTIES,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
A. J. Mehta, and E. Partheniades.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Technical Note, p 411-416, April 1979. 5 fig, 5 ref. NSF GK-31259.

Descriptors: *Erosion, *Cohesive soils, *Deposition(Sediments), *Laboratory tests, Movement, Suspended solids, Sediment transport, Sedimentation rates, Suspension, Tractive forces, Kaolinite, Incipient motion, Resuspension.

The phenomena of erosion and deposition of fine, flocculated, cohesive sediments were studied during the past several years. The first investigations, which were limited primarily to The erosion phase, were conducted in an open flume with recirculating water at ocean salinity with natural silty-clay sediments. Basic investigations of the depositional aspects of flocculated cohesive sediments were carried out more recently in an annular channel 60 inches in mean diameter, 8 inches wide, and 18 inches deep containing the water-sediment suspension, and an annular ring positioned within the channel and in contact with the water surface. A limited investigation of the resuspension properties of flow deposited sediment was carried out with a commercially available kaolinite in this apparatus. Limited experiments on the initiation of motion of sand grains in the annular channel-ring system showed a reasonable agreement with Shields' curve for incipient motion. The resuspension rates of stratified beds continuously decrease, and may even become zero, as the depth of erosion increases. On the other hand, the erosion rates of uniform beds remain constant. This is in agreement with earlier observations on natural bay deposits. The nondimensional plot of the erosion rate against the bed shear stress for uniform beds agrees with earlier results based on soils with drastically different mineralogical composition. (See also W75-05230, W76-04684, and W78-00078) (Humphreys-ISWS)
W79-06653

EROSION DEPOSITS IN TILE-DRAINS,
Macaulay Inst. for Soil Research, Aberdeen (Scotland).
E. Paterson, and B. D. Mitchell.
Agricultural Water Management, Vol. 1, No. 4, p 311-317, December, 1978. 2 fig, 1 tab, 6 ref.

Descriptors: *Tile drains, Tile drainage, Silting, Deposition(Sediments), *Soil erosion, Sedimentation.

The mechanism of silting up of tile field drains in two heavy textured surface water gley soils was examined by comparing the physical and mineralogical characteristics of deposits in drains with those of the clay soil directly above. The deposits consisted of clay, silt and sand and are distinctly laminated. They appeared to be the result of internal erosion of the soil. The processes operative seemed to have been: (a) inflow of soil through the drain joints; (b) sedimentation in the drain; (c) elution of very fine material. The possibility that this silting-up phenomenon is not uncommon in the tile field drains of surface water gley soils of Scotland was recognized. (Skogerboe-Colorado State)
W79-06694

EFFECT OF CHISEL VERSUS MOLDBOARD FLOWING ON SOIL EROSION BY WATER,
Science and Education Administration, Lafayette, IN. Soil, Water and Air Sciences.
For primary bibliographic entry see Field 4D.
W79-06695

INVESTIGATION OF THE SPEED OF BED LOAD MOVEMENT,
V. V. Romanovskiy.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 108-112, 1977. 2 fig, 10 ref, 1 append. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No. 242, p 71-81, 1977.

Descriptors: *Bed load, *Laboratory tests, *Theoretical analysis, *Sediment transport, Saltation, Foreign research, Sediments, Movement, Open channels, Analytical techniques, Methodology, Velocity, Traction, Roughness(Hydraulic), Hydraulics, *USSR.

To establish the relation between the speed of traction particles and their shape and flow velocity and to determine the lag of particles moving at the bottom behind their surrounding water mass, a theoretical study of the equation of motion of particles along the bottom and a laboratory investigation were described. The speed of bed load particles was determined experimentally in a small flume (7 m long and 0.2 m wide) and also in a large flume (0.5 m wide and 30 m long). The experiments were made with particles from 1.3 to 5.0 cm in diameter. The roughness of the flume bottom was uniform with projections of 0.02 cm, 0.15 cm, and 1 cm. The grains of the underlying surface were glued to the bottom of the flume. The results of the measurements were used to construct curves of the relation between the speed of particle traction and flow velocity. It was found that there is a

fairly close linear relationship between them, which is independent of the grain size of the underlying surface of the bottom. The tangent of the angle of slope of this straight line varies from 1.1 for spherical particles to 1.4 for flat particles. Analysis of the experimental data showed the following: (1) The speed of particles along the bottom (in the investigated range of relative coarseness 1.6 to 250) depends on the velocity of the streamline flow and is independent of the size of the projections (dimensions) of bottom roughness. (2) The lag of a particle behind the surrounding flow is a function of its initial traction speed and of its shape. (3) The lag of a particle behind its surrounding flow decreases with increasing flow velocity. (Humphreys-ISWS)
W79-06751

PRESENT AND POTENTIAL SEDIMENT YIELDS IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
E. D. Andrews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 677, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-105, December 1978. 33 p, 10 fig, 4 tab, 32 ref.

Descriptors: *Sediment transport, *Sediment yield, *Sediment load, *Streamflow, *Flow duration, Hydrographs, Curves, Land use, Coal mines, Topography, Geology, River basins, Planning, Sediment control, *Yampa River basin(Colo-Wyo).

Average annual suspended- and total-sediment loads in streamflow were determined by the flow-duration sediment-transport-curve method at 18 sites in the Yampa River basin, Colorado and Wyoming. These computations indicate that about 2.0 million tons of sediment are carried by the Yampa River at Deerlodge Park during an average year. Significant areal differences in the sediment yield from various parts of the basin also were determined. The lower Little Snake River subbasin contributes about 60 percent of the total basin sediment yield, although it represents less than 35 percent of the area and supplies less than 3 percent of the streamflow. In contrast, the upland (eastern) one-third of the basin contributes only about 14 percent of the sediment yield but 76 percent of the streamflow. Projected economic development of the basin, especially surface mining of coal, will impact the physical environment. Depending upon the amount and location of land disturbed, an estimated 10,000 to 30,000 tons per year of additional sediment will be contributed to the mainstem Yampa River. (Woodard-USGS)
W79-06825

MAN, RUNOFF AND THE EROSION OF THE COASTAL SLOPES OF ASHKELON, ISRAEL,
Tel Aviv Univ. (Israel). Dept. of Geography.
A. L. Marcus.
Geojournal, Vol. 2, No. 6, p 569-573, 1978. 10 fig, 6 ref.

Descriptors: *Coasts, *Shore protection, *Accelerated erosion, *Beaches, *Runoff, *Grazing, Coastal plains, Beach erosion, Coastal engineering, Slopes, Wind erosion, Erosion control, Hydrogeology, Waves(Water), Overland flow, Pastures, Social impact, Recreation wastes, Recreation demand, Urbanization, Israel.

Because of intensified recreational and bedouin grazing use of coastal areas, exemplified in this paper by a study of the Ashkelon area south of Tel-Aviv, beach erosion has become a serious problem for the Israelis. Increasing urbanization has introduced factors that contribute to slope runoff in sufficient volume to initiate slope erosion. Effects of such enlarged runoff volume include erosion of backslope areas and deposition of large alluvial fans on the beach footslope. Underlying sandstone cliffs are exposed and gullies deepened. Establishment of parking lots, storm sewer outlets, and stairways to beach areas have additional impact on the process, so that what first appears to be practical and normal recreational uses, instead create a series of unexpected and detrimental effects on this sensitive coastal environment. The effect of intensified bedouin grazing practices on dunes inland and along coastal cliffs, while less obvious and immediate, is nevertheless potentially detrimental also, as the vegetative cover is foraged and the sandy surface exposed to wind and water erosion. These two man-environment interactions have created a destabilization-denudation process of the entire hill chain in the area under study. (Tickes-Arizona)
W79-06838

2K. Chemical Processes

CHLORIDE AS A FACTOR IN MOBILITIES OF NI(II), CU(II), AND CD(II) IN SOIL,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
H. E. Doner.
Soil Science Society of America Journal, Vol 42, No 6, p 882-885, November-December, 1978. 5 fig, 3 tab, 15 ref.

Descriptors: *Trace elements, Metals, *Chlorides, Adsorption, Ion transport, Leachate, Chemical analysis, *Soil analysis, Laboratory tests.

The mobility of chloro-complexes of Ni(II), Cu(II), and Cd(II) through soil was studied. Soil columns were leached with 0.1, 0.2, 0.3, or 0.5M NaCl or CaClO4 solutions, each containing 10 microgram/ml Ni(II), Cu(II), or Cd(II). Sodium perchlorate solutions were used as a comparison with CaCl at the same ionic strength since perchlorate is not considered to form complexes with the metals. Leachates from columns and soils were collected and analyzed. Mobility of all metals tested in chloride solutions was from 1.1 to 4 times greater than that in ClO4(-) solution. Chloride increased the mobility of Cd(II) the most which corresponds to its having the largest stability constants. Copper (II) was slowest to appear in the leachate and was strongest asdorbed as evidenced by analysis of soil by digestion with either 4N HNO3 or acidified NH2OH-HCl. These results showed that Cl(-) has a marked effect on the mobility of Cd(II) and, to a lesser extent, Ni(II) and Cu(II). (Skogerboe-Colorado State)
W79-06553

LONG-TERM DENITRIFICATION STUDIES IN SOILS FERTILIZED WITH (15NH4)2SO4,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. D. Focht, and L. H. Stolzy.
Soil Science Society of America Journal, Vol 42, No 6, p 894-898, November-December, 1978. 6 fig, 1 tab, 31 ref.

Descriptors: *Denitrification, Nitrogen, Nitrates, *Nitrogen cycle, Soil gases, Lysimeters, Isotope studies, Fertilization.

A 2-year study was conducted in lysimeters containing four different soils with successive summer and winter crops of corn and barley, respectively. The crops were fertilized with (15NH4)2SO4 at application rates equivalent to 134, 108, 415, and 440 Kg N/ha for the respective summer 1973, winter 1974, summer 1974, and winter 1975 crops. The frequency of 15N dinitrogen samples was higher in the summer and higher at the lower fertilizer rates, while the reverse was true for NO3(-) concentrations in leach water and N2O concentrations in the soil profile. Emissions of N2O from soil, even where the higher concentrations were observed, were low in terms of N losses with the greatest mass emission at any time amounting to 6.5 g/ha over a 1-day period. Nitrogen gas emissions over a 1-week period in one instance were estimated at 5.2 kg N/ha; it was observed that this amount could be generated from low (1 ppm or less) concentrations of N2O. (Skogerboe-Colorado State)
W79-06554

SERIOUS INTERFERENCES IN THE DETERMINATION OF TRACE METALS IN SOILS BY FLAME AND FLAMELESS ATOMIC ABSORPTION SPECTROMETRY,
Montana Coll. of Mineral Science and Technology, Butte. Dept. of Chemistry.
For primary bibliographic entry see Field 2G.
W79-06555

IONIC STABILITY OF PRECIPITATION SAMPLES,
Illinois State Water Survey, Urbana. Atmospheric Sciences Section.
M. E. Peden, and L. M. Skowron.
Atmospheric Environment, Vol. 12, No. 12, p 2343-2349, 1978. 6 fig, 10 ref. EY-76-S-02-1199.

Descriptors: *Chemistry of precipitation, *Sampling, *Chemical analysis, *Ions, Precipitation(Atmospheric), Rainfall, Snowfall, Chemicals, Filtration, Data collections, Equipment, Dusts, Air pollution, Fallout, Chemistry, Meteorology, Ionic stability, Precipitation sampling.

Event and weekly precipitation sampled with 3 types of collectors was stored under 5 different conditions and analyzed throughout a 6-week time period to monitor changes in ionic composition. Ca(++), Mg(++), Na(++), K(+), H(+), NH4(+), SO4(--), NO3(-), and Cl(-) were the constituents under observation. Dramatic variations in the concentrations of some species are attributable to the sample particulate loading. Although cooling retarded changes in ionic composition, immediate filtering after wet-only collection was the most effective means of retaining sample integrity and preventing adsorption-desorption reactions. (Sims-ISWS)
W79-06602

COMBINED MEASUREMENT OF OXYGEN AND SULFIDE IN WATER SAMPLES,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
K. Ingvorsen, and B. B. Jorgensen.
Limnology and Oceanography, Vol. 24, No. 2, p 390-393, March 1979. 3 fig, 17 ref.

Descriptors: *Chemical analysis, *Oxygen, *Sulfides, Water chemistry, Laboratory tests, Sampling, On-site data collections, On-site investigations, Hydrogen sulfide, Dissolved oxygen, Water quality, Chemistry.

A method was described for chemical determination of oxygen and sulfide in the same water sample. Sulfide is first separated by precipitation with zinc hydroxide, oxygen then determined by the Winkler technique in the clear supernatant. The mutual interference between the oxygen and the sulfide determinations is less than 1-2%. The method has proven useful for field applications: as an example, the diurnal variation in oxygen and sulfide of a shallow lagoon was presented. (Sims-ISWS)
W79-06699

A KINETIC STUDY OF THE CAC03 PRECIPITATION REACTION,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
J. T. Gilmour, K. S. Shirk, J. A. Ferguson, and C. L. Griffis.
Agricultural Water Management, Vol. 1, No. 3, p 253-262, November, 1978. 2 fig, 4 tab, 10 ref.

Descriptors: *Chemical precipitation, Chemical reactions, Soil chemistry, *Calcium carbonate, Magnesium carbonate, Mathematical models, Rice.

In order to develop water management practices which would minimize localized precipitation of Ca and Mg carbonates on Arkansas' rice fields, a description of the precipitation reaction was needed. Waters studied were prepared solutions which contained varying amounts of Ca(HC03)2 and/or MgC12, and subterranean water samples collected in the field. These waters were monitored for Ca and Mg loss due to carbonate precipi-

tation under unseeded spontaneous conditions. The rate of Ca loss from solution was adequately described by first order kinetics where Ca was the rate determining ion. An empirical equation was developed which showed the rate constant could be calculated from temperature and solution composition data. An evaluation of the rates of Ca and Mg loss from solution for the experimental periods studied showed that Mg losses were small when compared to Ca losses. (Skogerboe-Colorado State)
W79-06703

A SOIL-WATER-NITROGEN MODEL FOR IRRIGATED CORN ON SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. G. Watts, and R. J. Hanks.
Soil Science Society of America Journal, Vol. 42, No. 3, p 492-499, May-June, 1978. 8 fig, 25 ref, 1 append. OWRT B-024-NEB(2). 14-31-0001-4101.

Descriptors: *Nitrogen, Nitrates, Leaching, Model studies, *Soil-water-plant relationships, Sweet corn, Water balance, Irrigation.

A model was developed which describes the net changes of nitrogen amounts due to transformations and the movement, uptake, and loss of nitrogen from the root system of irrigated corn (Zea mays L.) grown on sandy soils. A potential nitrogen uptake function developed from field data is used to determine the maximum uptake for nonlimiting soil water and nitrogen availability. Actual uptake is calculated as less than potential when soil water content and/or mineral nitrogen concentration and distribution limit convective and diffusive movement of nitrate to the root system. Separate calculations are made for uptake resulting from each of these two mechanisms. Seasonal nitrogen uptake was computed within 15% of measured uptake on field plots where uptake by above ground plant material ranged from 105 to 218 kg/ha. Computed nitrate leaching losses compared favorably with losses estimated by multiplying percolation loss determined from a weekly water balance, by measured nitrate concentration at 150 cm depth. Field leaching losses estimated by the water balance-concentration method ranged from 37 to 154 kg/ha. (Skogerboe-Colorado State)
W79-06736

RATES OF WEATHERING AND SOIL FORMATION ON GRANITE IN RHODESIA,
Science and Education Administration, Coschocton, OH.
For primary bibliographic entry see Field 2A.
W79-06741

THE INFLUENCE OF ELECTROLYTE CONCENTRATION ON FLOCCULATION OF CLAY SUSPENSIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W79-06761

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06814

MARYLAND GROUND-WATER INFORMATION: CHEMICAL QUALITY DATA,
Geological Survey, Towson, MD. Water Resources Div.
R. S. Woll.
Maryland Geological Survey Water Resources Basic-Data Report No 10, 1978. 126 p, 27 tab, 4 ref.

Descriptors: *Water quality, *Groundwater, *Chemical analysis, *Maryland, Data collections, Water wells, Geologic units, Water analysis, Physical properties, Sampling, Sites, Maps, Basic data collections.

Water-quality data from approximately 1600 wells and springs in Maryland are tabulated. The data represent all the ground-water samples collected and analyzed by the U.S. Geological Survey in Maryland during the period 1942-1974. (Woodard-USGS)
W79-06820

2L. Estuaries

FLUCTUATIONS OF CHLOROPHYLL AND RELATED PHYSICAL PARAMETERS IN BRITISH COLUMBIA COASTAL WATERS,
British Columbia Univ., Vancouver. Inst. of Oceanography.
R. C. Wiegand, and S. Pond.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 113-121, February 1979. 7 fig, 29 ref.

Descriptors: *Water quality, *Straits, *Canada, *On-site tests, On-site investigations, Data collections, Salinity, Water temperature, Dissolved oxygen, Chlorophyll, Profiles, Spatial distributions, Water properties, Bodies of water, Analysis, Sampling, Methodology, Statistical methods, Water sampling, Fluctuations, Coasts, Analytical techniques, *British Columbia, *Strait of Georgia(British Columbia), Spectral analysis.

Continuous horizontal profiles of chlorophyll, temperature, salinity, and oxygen were made at 3 depths and in 3 locations in British Columbia coastal waters, and spectra and cross-spectra were calculated. Generally, fairly strong relationships exist between chlorophyll and temperature and salinity, especially at scales of order 10-1000 m. However, the relationships are not always expressed through the same physical parameter. It is apparent from coherence and phase data that in a turbulent environment, the vertical profiles of the parameters are important in determining the nature of the relationships. Average spectra show power law relationships similar to the results of other authors. Profiling fairly rapidly, as well as moving horizontally, would allow better resolution of both horizontal and vertical variations and was recommended for future investigations. (Humphreys-ISWS)
W79-06644

SPECTRAL AND BIOCHEMICAL CHARACTERISTICS OF THE PARTICULATE MATTER IN BEDFORD BASIN,
Biochimie Marine, Villefranche-sur-Mer (France). Station Zoologique.
P. Mayzaud, and S. Taguchi.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 211-218, February 1979. 3 fig, 5 tab, 24 ref.

Descriptors: *Phytoplankton, *Organic matter, *Carbohydrates, *Estuaries, Proteins, Carbon, Microorganisms, Aquatic microorganisms, Chlorophyll, Temperature, Salinity, Density, Diatoms, Dinoflagellates, Plankton, Water quality, *Bedford Basin, Copepods, Tintinnids.

A survey of the distribution, nature, and biochemical composition of particulate matter (less than 153 micrometers diam) showed that small particles (less than 18 micrometers) made up the bulk of the particulate matter during most of the summer. Relatively large amounts of microzooplankton (tintinnids) were also recorded during the period of stable hydrographic conditions. Diatoms and dinoflagellates were abundant only in early fall prior to the fall bloom. All cell counts were transformed into parts per million on a volume basis to compare with Coulter Counter data. Cell counts on preserved samples strongly underestimated the number and volume of small particles and did not take into account the detritus. Considerations of the ATP content strongly suggested that for naturally occurring particulate matter there is not a constant ATP to carbon ratio, but rather there is an upper and lower limit. Small particles were the main repository for protein, whereas phytoplankton was the repository for carbohydrates. The high variability of both quality and quantity of particles in the neritic habitat suggests that a single chemical variable cannot describe fully the nutritive value of naturally occurring suspended matter. (Sims-ISWS)
W79-06645

SUMMER PLANKTON DISTRIBUTIONS ASSOCIATED WITH THE PHYSICAL AND NUTRIENT PROPERTIES OF THE NORTHWESTERN GULF OF ST. LAWRENCE,
Quebec Univ., Rimouski. Dept. of Oceanography.
J. M. Sevigny, M. Sinclair, M. I. El-Sabh, S. Poulet, and A. Coote.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 187-203, February 1979. 14 fig, 2 tab, 28 ref.

Descriptors: *Plankton, *Nutrients, *Physical properties, *Gulfs, *Estuaries, *St. Lawrence River, Sampling, Surveys, Data processing, Phytoplankton, Diatoms, Dinoflagellates, Aquatic microorganisms, Biomass, Currents(Water), Water circulation, Density, Salinity, Phosphates, Silicates, Nitrates, Water quality, *Gulf of St. Lawrence, Copepods.

Two transects, north-south and east-west, through the Anticosti gyre and the Gaspe current were sampled for physical properties, nutrient, and plankton concentrations over a 5-day period during July 1976. Temperature, salinity, sigma sub t and nutrient isolines formed a dome characteristic of cyclonic circulation with the apex within the Anticosti gyre, but a strong shallow thermocline prevented nutrient enrichment of the surface mixed layer. Surface nitrate and silicate concentrations were very low, except for 2 anomalies throughout the region sampled, with phosphate concentrations higher. Phytoplankton biomass was uniformly low and dominated by nannoplankton (less than 15 micrometers) was important and the total biomass considerably higher. The higher biomass and importance of larger celled species suggest higher nutrient turnover in the Gaspe current. Nitzschia delicatissima dominated the species composition in the Gaspe current, dinoflagellates and microflagellates being of more importance within the gyre and along the north shore. Zooplankton biomass was distributed fairly uniformly over the entire region, but species composition at the shallower stations was characterized by small copepod species and fish larvae, the gyre stations being characterized by larger copepod species, euphausids, and decapod larvae. (Sims-ISWS)
W79-06646

DISTRIBUTION OF NUTRIENTS IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
A. R. Coote, and P. A. Yeats.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 122-131, February 1979. 11 fig, 1 tab, 20 ref.

Descriptors: *Nutrients, *Distribution patterns, *Gulfs, *Estuaries, *St. Lawrence River, Sampling, Surveys, Data processing, Silicates, Nitrates, Phosphates, Winter, Summer, Water quality, Path of pollutants, Sediments, *Gulf of St. Lawrence.

The general pattern of nutrient distribution in the Gulf of St. Lawrence results from regeneration processes being superimposed on the physical processes of estuarine circulation within the Gulf. This leads to a general increase in nutrient concentration with depth and with distance into the Gulf from Cabot Strait. Nutrient concentrations in the Laurentian Channel are higher inside the Gulf than at equal or even greater depths in the Atlantic Ocean some distance outside Cabot Strait. Summer nutrient concentrations in the surface layer are generally low. However, during the winter when biological activity is low, quite high concentrations of the nutrients are found in the surface waters of the Gulf. A balance exists between inward and

outward fluxes of all 3 nutrients through Cabot Strait in the winter. However, in the summer, the influxes of both nitrate and silicate at Cabot Strait greatly exceed the outgoing fluxes. Losses of biogenic silica to the sediments may account for the silicate imbalance. Excess nitrate may be accounted for if ammonia or nitrogen bound with dissolved organics had been measured. (Sims-ISWS)
W79-06650

LINE PLUME AND OCEAN OUTFALL DISPERSION,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-06651

CARBON AND OXYGEN ISOTOPE RATIOS IN THE SAGUENAY FJORD AND THE ST. LAWRENCE ESTUARY AND THEIR IMPLICATIONS FOR PALEOENVIRONMENTAL STUDIES,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
P. M. Strain, and F. C. Tan.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 119-126, February 1979. 3 fig, 3 tab, 13 ref.

Descriptors: *Isotope studies, *Estuaries, *St. Lawrence River, *Canada, Carbon, Oxygen, Carbon dioxide, Sampling, Surveys, Mathematical models, Paleoclimatology, Water temperature, Salinity, Climatology, *St. Lawrence Estuary, *Saguenay Fjord.

Surface water samples (1 m depth) from the Saguenay Fjord and the upper St. Lawrence Estuary were analyzed for delta 13C, Sigma C02, and delta 180. In the Saguenay Fjord, the delta 13C sub PDB and concentration of the total dissolved C02 varied from -10.9 parts per thousand and 3.6 ml/l near the head to -0.4 parts per thousand and 30.3 ml/l at the mouth. The upper St. Lawrence Estuary exhibited a delta 13C range of -4.2 to -1.6 parts per thousand and a sigma C02 concentration range of 19.8 to 37.6 ml/l. The measured delta 13C, sigma C02, delta 180 and salinity distributions were compared to a conservative mixing model. The excellent agreement between the measured and predicted delta 13C values in the Saguenay Fjord indicated that the carbon isotope ratio behaves conservatively. In the upper St. Lawrence Estuary, the much poorer agreement suggested that significant in situ processes involving the dissolved C02 are operative. The suggestion that estuarine paleotemperatures may be obtained by extrapolating delta 13C - delta 180 shell carbonate curves to marine conditions is open to criticism. The delta 13C - delta 180 water curves observed in this work illustrated two different situations that could produce errors in paleotemperatures estimated by this method. (Sims-ISWS)
W79-06654

CONCENTRATIONS AND TEMPORAL VARIATIONS OF 210PO, 210PB, AND AL IN THE SURF ZONE ECOSYSTEM OF COPALIS BEACH, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
J. T. Bennett, and R. Carpenter.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 127-140, February 1979. 2 fig, 3 tab, 38 ref. ERDA E(45-1)-2225-TA24, EPA T900313-04.

Descriptors: *Diatoms, *Lead, *Aluminum, *Surf, *Washington, Benthos, Beaches, Coasts, Phytoplankton, Isotope studies, Sampling, Surveys, Seasonal, Aquatic microorganisms, Aquatic life, *Copalis Beach(WA), *Polonium.

Surf diatoms monitored during a 21-month period at Copalis Beach, Washington, contained elevated concentrations of Al, 210Pb, and supported 210Po compared to net phytoplankton from Washington coastal waters and Puget Sound. Aluminum concentrations of several percent dry weight found in the surf diatoms were not a reflection of contamination by discrete inorganic particulate matter but were the result of a natural coating of clay-sized particles on Chaetoceros armatum, the predominant diatom in the surf blooms. A high correlation between Al and 210Pb in the surf diatoms suggests that 210Pb and supported 210Po were also associated with the clay-sized particles. During fall through spring, the unsupported 210Po concentrations in the surf diatoms were correlated with the input of 210Po by precipitation. A summer maximum in unsupported 210Po concentrations in the surf diatoms may reflect upwelling that causes higher dissolved 210Po concentrations in the summer surf relative to those of late spring and early fall. The consumers of the surf diatoms exhibited larger 210Po-activity-to-210Pb-activity ratios than their food, indicating 210Po was preferentially accumulated in the higher trophic level. (Sims-ISWS)
W79-06655

EFFECTS OF SEWAGE SLUDGE ON THE BENTHIC INVERTEBRATE COMMUNITY OF THE INSHORE NEW YORK BIGHT,
Brooklyn Coll., NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-06656

SEASONAL FLUCTUATIONS IN COASTAL BENTHIC INVERTEBRATE ASSEMBLAGES,
Delaware Univ., Lewes. Marine Studies Complex.
D. Maurer, W. Leathem, P. Kinner, and J. Tinsman.
Estuarine and Coastal Marine Science, Vol 8, No 2, p 181-193, February 1979. 3 fig, 6 tab, 20 ref.

Descriptors: *Marine animals, *New York, *New Jersey, *Invertebrates, *Benthic fauna, *Atlantic Ocean, Sediments, Benthos, Sampling, Surveys, Marine biology, Classification, Data processing, Seasonal, Biology.

During 4 quarterly sampling cruises at 2 areas off the Delaware coast, 288 quantitative benthic invertebrate samples were collected. Species composition, species dominance (abundance and frequency of occurrence), density, and species evenness were compared. Based on cluster analysis, 3 species-site groups emerged: (1) a high energy shoal assemblage characterized by a year-round suite of haustoriids and a few bivalves, (2) a mixed hard bottom-sand assemblage that featured marked seasonal dominance of Mytiilus edulis with a variety of seasonal epifaunal and infaunal species, and (3) a medium sand assemblage with a variety of seasonal infaunal species. Similar assemblages have been recognized off New Jersey and New York. Seasonal fluctuations in undisturbed coastal invertebrate assemblages can be so marked that many environmental impact studies are inadequate to assess the effects of human activities. (Sims-ISWS)
W79-06657

METEOROLOGICAL FORCING OF COASTAL WATERS BY THE INVERSE BAROMETER EFFECT,
Harbor Branch Foundation, Fort Pierce, FL.
N. P. Smith.
Estuaries and Coastal Marine Science, Vol 8, No 2, p 149-156, February 1979. 3 fig, 13 ref.

Descriptors: *Water levels, *Atmospheric pressure, *Gulf of Mexico, *Texas, *Florida, Tides, Variability, Winds, Pressure, Atmosphere, Coasts, Time series analysis, Analytical techniques, Data processing, Data collections, Oceanography, Air-sea interaction.

Water level and surface pressure data from the northeastern and northwestern Gulf of Mexico were used to investigate the water level response to meteorological forcing by the inverse barometer effect. Statistically significant coherence-squared values were computed for variations in cross-Gulf surface pressure and water level differences over time scales on the order of 2 to 6 days. Water level variations of approximately + or -4-5 cm were postulated for the northern Gulf of Mexico in response to surface pressure differences. Meteorological forcing by the inverse barometer effect appeared to be significantly greater in the winter months, when cross-Gulf air pressure differences of up to + or -20 mb were recorded. (Sims-ISWS)
W79-06658

VENICE: SEA-LAGOON EXCHANGE IN A MODIFIED TIDE RANGE,
Consiglio Nazionale delle Richerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grandi Masse.
O. Vittori, and F. Tampieri.
Science, Vol. 204, No. 4390, p 261-264, April 20, 1979. 2 fig, 19 ref.

Descriptors: *Tidal waters, *Lagoons, *Model studies, *Water quality, *Europe, Analytical techniques, Salinity, Water levels, Tides, Tidal effects, Mathematical models, Freshwater, Water level fluctuations, Inlets(Waterways), Foreign research, Estuaries, *Italy, *Venetian Lagoon(Italy).

Salinity and tide heights recorded for a month at P, a point in the northern section of the Venetian lagoon, are the basic experimental data used to construct a numerical model which describes the salinity variations at P as a function of the tides measured at the Lido entrance. The time variation of the salinity pattern was interpreted in terms of a lagoon system in which a freshwater source of constant intensity is in a quasi-steady equilibrium with a tide-modulated sink. The mean residence time of a contaminant in this simulated lagoon was predicted from the change in the salinity pattern due to a reduction in the entrance size. The limits of the present results were set by the limitation of the available data and by the consequent necessity of highly simplified modeling. The data may not be sufficient to properly represent P. However, owing to the lack of a large-scale study and the necessity for the Italian government to make a decision within a short time, it was considered necessary to present the simplified modeling approach. This approach has the purpose of producing evidence that a nonlinear effect may occur in the sea-lagoon exchange as a consequence of a reduction in the entrance size. Moreover, it supports the action of those, in Italy and elsewhere, who require that pollution concentrations in the Venetian lagoon be quantitatively predicted before any permanent change in the lagoon tide regime is made. (Humphreys-ISWS)
W79-06659

COMBINED MEASUREMENT OF OXYGEN AND SULFIDE IN WATER SAMPLES,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
For primary bibliographic entry see Field 2K.
W79-06699

TEMPERATURE FINE STRUCTURE NEAR THE SEA-ICE MARGIN OF THE CHUKCHI SEA,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
R. G. Paquette, and R. H. Bourke.
Journal of Geophysical Research, Vol. 84, No. C3, p 1155-1164, March 20, 1979. 15 fig, 1 tab, 24 ref. N66001-76-PO-00610.

Descriptors: *Water temperature, *Sea ice, *Salinity, Surveys, Sampling, On-site investigations, Ice, Melting, Oceans, Temperature, Distribution patterns, Temporal distribution, Spatial distribution, Variability, Oceanography, *Chukchi Sea.

Temperature fine structure with peak-to-peak fluctuations often exceeding 2C is prevalent throughout the marginal sea-ice zone of the shallow Chukchi Sea in midsummer. It is normally found within 20-35 km outside of the ice and seldom farther than 5-10 km inside the ice margin. It has also been infrequently found more than 100 km south of the ice. Temperature and salinity fronts of all degrees of sharpness occur in the same general area, but the two types need not be coincident. Considerable variability in time and length scales of fine structure elements has been noted with persistences ranging from 2 hours or less to more than 20 hours

and length scales ranging from 600 m to more than 20 km. While much of this variability is intrinsic, part can be accounted for by the inability to sample in the direction of flow and the relative motion between the sampling platform and fine structure element. Fine structure lenses are considerably longer parallel to the ice edge, with similarity in temperature structure noted over distances of 80 and 100 km. (Sims-ISWS)
W79-06739

A DYNAMICAL ANALYSIS OF CURRENTS NEAR THE NEW JERSEY COAST,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. R. Bennett, and B. A. Magnell.
Journal of Geophysical Research, Vol. 84, No. C3, p 1165-1175, March 20, 1979. 9 fig, 2 tab, 6 ref. BNL 357213-S.

Descriptors: *Ocean currents, *Currents(Water), *New Jersey, *Coasts, *Model studies, Mathematical models, Winds, Circulation, Water circulation, Ocean circulation, Shores, Oceans, Shear, Stress, On-site investigations, On-site data collections, Data processing, Analytical techniques, Oceanography, *New York Bight.

A numerical model was used to analyze currents measured on the continental shelf near the shore of New Jersey. The model neglected longshore variations of current and all variations of density, but it included inertial accelerations and a nonlinear eddy viscosity. Local wind stress, sea level changes, and a constant longshore pressure gradient were the forcing terms. The model successfully reproduced most of the current variances. However, the predicted currents did not exhibit the dominant 4-hour response time of the observed currents, and the model sometimes missed energetic current events. These differences were ascribed to three-dimensional setup effects elsewhere in the New York Bight. (Sims-ISWS)
W79-06740

THE MEASUREMENT OF INTERACTIVE FRESHWATER AND TIDAL FLOWS IN THE RIVER DEE, NORTH WALES,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
A. E. Weston.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 1, p 69-79, January 1979. 8 fig, 1 ref.

Descriptors: *Rivers, *Tidal waters, *Estuaries, *Water levels, Tidal effects, Freshwater, Discharge(Water), Tides, Data collections, On-site investigations, Analytical techniques, Chlorides, Water quality, Saline water intrusion, Tidal streams, Watersheds(Basins), Rating curves, Foreign research, Foreign countries, *Wales, *River Dee(Wales), Flow reversal.

The area of interaction between tides and freshwater flows ranges from Hilbre Island, at the mouth of the Dee Estuary, to Pickhill, 70 km inland and 30 km upstream of the ancient weir at Chester, which greatly influences the hydraulics of the reach. Freshwater flows down the Dee would normally vary naturally between 2 and 180 cu m/sec, and tide levels at Liverpool (equivalent to the mouth of the estuary) vary from 6.24 m AOD Newlyn (at a return period of 1 in 100 years) to 1.60 m AOD Newlyn at neap tides. The Dee, being a regulated river, supports continuous abstractions by statutory water undertakings of 6 cu m/sec at present from the lower reaches upstream of Chester Weir. This will rise to 8.5 cu m/sec by the early 1980's, making the Dee the largest single source of potable water in Wales or Northern England. In addition, industrial abstractions of 4.5 cu m/sec take place from the estuary downstream of Chester Weir. The paper discussed the development of operational systems needed to forecast tidal peaks, tidal-affected river levels, and saline intrusions from a series of relatively simple hydrometric and chemical measurements. Although there is considerable scope for the extension of this work into a computer-based mathematical modelling system, the value of accurate basic measurements, interpreted rationally and presented concisely, should not be underestimated. The paper indicated how a quantitative understanding of the relationship between tidal and freshwater flows in the lower Dee has been gained from simple but precise hydrometric observations and standard chemical sampling. With the exception of the ultrasonic discharge meter, no large capital investment has been necessary. The results obtained provide a useful set of simple operational prediction methods which are extensively used in the Authority's day-to-day management of the Dee system. The work could also form a basis for the development and refinement of any mathematical model of the tidal section of the river. (Humphreys-ISWS)
W79-06747

EXPERIMENTAL NUMERICAL SIMULATION OF UNSTEADY WATER FLOW IN A MULTIBRANCH RIVER DELTA,
V. V. Ivanov, and Ye. P. Kotrekhov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 141-150, 1977. 4 fig, 4 tab, 9 ref. Translated from Transactions of the Arctic and Antarctic Scientific Research Institute (Trudy AANII), Vol. 314, p 16-35, 1976.

Descriptors: *Estuaries, *Rivers, *Unsteady flow, *Model studies, Deltas, Flow, Mathematical models, Theoretical analysis, Analytical techniques, Foreign research, Discharge(Water), Tidal waters, Waves(Water), Water levels, Wind tides, Water level fluctuations, *USSR, *Kolyma Estuary(USSR), Multibranch river delta.

The most suitable among the computation methods developed in the USSR for creating a mathematical model of an intricately branching delta is that of the Institute of Hydrodynamics of the Siberian Branch of the USSR Academy of Sciences. This method (IH) has been used successfully to study the interaction between aperiodic sea level fluctuations and river runoff on a numerical model of a single-arm estuary. The estuary of the Kolyma River was used to investigate the possibility of applying the modification of the IH method to the mathematical simulation of unsteady water flow in a multibranch delta. To describe one-dimensional flow in a river estuary, the St. Venant equations were written for an arbitrary system of channels. The computation scheme and the initial data forming the basis of the mathematical model of the Kolyma estuary were presented. The use of numerical simulation of the water regime of intricately branched deltas, based on methods of computation of unsteady flow, makes it possible to obtain the characteristics of one-dimensional flow. The method investigated makes it possible to supplement existing information and sometimes to obtain completely new information on the hydraulic regime of flow in the intricately branched deltas of large rivers. In this case, one can investigate some important patterns along river estuaries of propagation of long waves produced by wind set-up, floods, and tides. All this indicates the great potential of the method for solving some practical problems associated with water transport, hydraulic power engineering, and other branches of industry. (Humphreys-ISWS)
W79-06749

AN EXPERIMENTAL STUDY OF BRINE DRAINAGE AND CONVECTION IN YOUNG SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2C.
W79-06757

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 2E.
W79-06758

DESIGN WAVE HEIGHT AND WAVE PERIOD OF SEA WAVES AT DIGHA,
River Research Inst., Calcutta (India). Haringhata Central Lab.
S. K. Daskaviraj, and S. K. Sarkar.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 29, No. 3, p 541-546, July 1978. 9 fig, 6 ref.

Descriptors: *Waves(Water), *Ocean waves, *Beaches, Design data, Statistics, Probability, Measurement, Frequency, Data processing, Curves, Coasts, Coastal engineering, *India, *Digha(India), Design wave height.

The most probable height and period of the waves which will occur in any given length of time were determined from systematic instrumental records of sea waves at Digha. In determining the design wave height and wave period the method as suggested by Draper was used. Cumulative distribution of the highest and the significant wave heights and the distribution of wave periods in percentage of occurrence also were presented. (Sims-ISWS)
W79-06770

AN ENVIRONMENTAL SURVEY OF CANTON ATOLL LAGOON, 1973,
Naval Undersea Center, Kailua, HI. Hawaii Lab. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A028 023, Price codes: A09 in paper copy, A01 in microfiche. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, June 1976, 200 p. Smith, S. V. and Henderson, R. S., editors. DOAF, MIPR FY7616-74-00-202, EPA R800906.

Descriptors: *Atolls, *Lagoons, *Water quality, *Geomorphology, *Aquatic environment, Tidal waters, Biota, Aquatic life, On-site investigations, Hydrologic budget, Reefs, Coral, Surveys, Analytical techniques, Suspended solids, Water properties, Groundwater, Surface waters, Estuaries, *Canton Atoll.

Canton Atoll has a single passage between the ocean and lagoon and has conspicuous environmental gradients from that passage to the back lagoon. These gradients include the physiography of the lagoon floor, water quality, and the diversity and abundance of corals, fishes, and mollusks. The gradients apparently can be attributed either directly or indirectly to circulation and water motion within the lagoon. Those oceanographic characteristics, in turn, can be attributed to the geological history of the atoll, including some human modification of the pass configuration. In addition to the studies of the atoll lagoon, the characteristics of the groundwater system were noted. Evidence from isolated standing water bodies on the atoll demonstrates that these features show considerable variability, which may be attributed to a combination of the immediately previous history of these bodies as well as to the physiography of the atoll. (See W79-06882 thru W79-06888) (Humphreys-ISWS)
W79-06881

CANTON ATOLL LAGOON PHYSIOGRAPHY AND GENERAL OCEANOGRAPHIC OBSERVATIONS,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
R. S. Henderson, P. L. Jokiel, S. V. Smith, and J. G. Grovhoug.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 5-14, June 1976. 6 fig, 2 ref.

Descriptors: *Atolls, *Lagoons, *Geomorphology, *Tidal waters, Tides, Reefs, Dredging, Inlets(Waterways), Surveys, Water circulation, On-site investigations, Water levels, *Canton Atoll.

The 4 major physiographic zones of the Canton Atoll lagoon are defined as the Pass Zone, the Line Reef Zone, the Back Lagoon Zone, and the Altered Zone. Each of these zones has a characteris-

ic physiography, biota, and water quality. The Altered Zone is noteworthy, because it appears to ıave originated from the degradation of other :ones brought about by dredge and fill operations. There does not appear to be any other major rtificial damage to the lagoon, aside from direct nechanical destruction by dredging. The predomiıant aspects of lagoon circulation are wind drift nd tidal flow. Although lagoon tides show a ronounced lag with respect to the ocean tides, here is no measurable amplitude attenuation from he ocean to the back lagoon. (See also W79-6881) (Humphreys-ISWS)
V79-06882

WATER COMPOSITION AND BIOGEOCHEMICAL GRADIENTS IN THE CANTON ATOLL LAGOON,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
. V. Smith, and P. L. Jokiel.
n: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 15-53, June 1976. 19 fig, 6 tab, 51 ref.

Descriptors: *Atolls, *Lagoons, *Water properties, On-site investigations, Water quality, Sedimentation, Analysis, Analytical techniques, Aquatic environment, Tidal waters, Hydrologic budget, Salinity, Nutrients, Evaporation, Mathematical models, Nutrient removal, Phosphorous, Water sampling, Calcium carbonate, Alkalinity, Chlorophyll, Nitrates, Ammonia, *Canton Atoll.

udgets of water, salt, nutrients, carbon dioxide, ıspended material, and sediments can be used to stablish the dynamics of water exchange, biogeohemical reactions, and sedimentation in the anton Atoll lagoon. Maximum water residence me in the lagoon is about 95 days. During that me, net evaporation raises the salinity nearly 4 arts per thousand above oceanic values. Phospho-ıs utilization in the lagoon is 0.027 mmole/sq m/ ay; nitrogen utilization is about 8.5 times this rate. et excess organic carbon production is assumed be 100 times the rate of phosphorus utilization hat is, about 3 mmole/sq m/day, or 36 mg C/sq /day). Gross production, as inferred from gas xchange between the air and water, is 6 g C/sq /day. CaCO3 production is 14 mmole/sq m/day, r 1.4 g CaCO3/sq m/day. Most of the CaCO3 roduced in the lagoon remains there, but a subantial portion of the organic carbon produced is st from the lagoon. Water motion is the paramer exerting major influence on the metabolism of e lagoon biotic community. Artificial alteration f water movement patterns has changed part of at community. Neither nitrogen nor phosphorus likely to limit metabolism of the biota. CaCO3 roduction in the lagoon has probably been suffient to fill the lagoon with about 20 m of sediment ver the past 8,000 years. It is likely that the esent episode of lagoon reef growth has been ntinuing for that timespan and that the CaCO3 roduction rate has decreased substantially over at period. (See also W79-06881) (Humphreys-SWS)
79-06883

EEF CORALS OF CANTON ATOLL: I. ZOOEOGRAPHY,
aval Undersea Center, Kailua, HI. Hawaii Lab.
E. Maragos, and P. L. Jokiel.
: An Environmental Survey of Canton Atoll agoon, 1973. Final Report NUC TP 395, Naval ndersea Center, Hawaii Laboratory, Kailua, awaii, p 55-70, June 1976. 3 tab, 19 ref.

escriptors: *Pacific Ocean, *Indian Ocean, Atolls, *Geomorphology, *Reefs, *Surveys, On-e investigations, Tidal waters, Coral, Marine anials, Aquatic life, Data collections, *Phoenix land, *Canton Atoll, Coral fauna, Hermatypic orals, Ahermatypic corals.

his paper described the hermatypic and ahermapic corals collected at Canton Atoll in 1972 and 73. Over 75 species and 36 genera and subgenera reef corals were reported. When combined with e new records reported at McKean Atoll, these records nearly double the number of species and genera previously reported for the Phoenix Islands. Although the Phoenix Island coral fauna is considerably more diverse than previously estimated and more diverse than reported for island groups to the east, island groups to the west show much higher coral diversities. These findings are consistent with the overall trend, previously noted by Wells and others, of a decreasing number of coral species and genera from west to east across the tropical Pacific. Investigations also revealed that significant dissimilarities exist between the species and generic lists of Canton and adjacent islands and island groups in the Central Pacific. Although some of the apparent discontinuities in the distribution of certain corals may be artifacts resulting from variable or incomplete sampling, some are apparently real. The causes for the local suppression of certain genera and species from some islands and their abundance on others nearby are unknown but are probably related to geographic isolation or variations in the local rates of immigration and extinction of coral species. Comparison of the Phoenix data with previously reported coral distributions in the Indian Ocean seemed to support the theory that the Indo-Pacific reef coral fauna shows a homogenous distribution. (See also W79-06881) (Humphreys-ISWS)
W79-06884

REEF CORALS OF CANTON ATOLL: II. LOCAL DISTRIBUTION,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
P. L. Jokiel, and J. E. Maragos.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 71-97, June 1976. 7 fig, 10 tab, 18 ref.

Descriptors: *Surveys, *Atolls, *Reefs, *Geomorphology, Coral, Aquatic animals, Ecological distribution, On-site investigations, Spatial distribution, Water quality, Salinity, Tidal waters, Analysis, Analytical techniques, Data collections, Sediments, *Canton Atoll, Lagoon fauna.

Although undoubtedly of great importance as reef-formers, corals occupy only a few percent of the total bottom area at Canton Atoll. Distribution and abundance of the 77 reported species of reef corals at Canton appear to be controlled largely by biological interaction (that is, competition for space) at intermediate depths on the ocean reef slope and largely by physical factors (increased salinity, sedimentation, and turbidity; decreased water motion; and possibly available nutrients) in the lagoon. Coral coverage and number of species present in the lagoon decrease with increasing distance from the single passage where lagoon water exchanges with the open ocean. Canton is geographically isolated from atolls having extensive lagoon systems. Furthermore, exchange of lagoon water with the open ocean is confined to one passage along the atoll rim. Consequently, the lagoon fauna lacks 'exclusively lagoon' species of corals. Apparently the lagoon reefs have been colonized by a few of the abundant ocean-reef species. Widespread Indo-Pacific species belonging to the genera Pocillopora, Acropora, Montipora, and Millepora account for much of the coral coverage. In addition, several species uncommon elsewhere (including Hydnophora rigida and Halomitra philippinensis) account for an unusually large portion of the total coverage in some habitats. An abundance of fungiid species (8 genera and subgenera) is one of the most striking and unusual features of the coral fauna, along with an extensive lagoon line reef system dominated by Millepora. (See also W79-06881) (Humphreys-ISWS)
W79-06885

DISTRIBUTION OF INSHORE FISHES AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
J. G. Grovhoug, and R. S. Henderson.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 99-157, June 1976. 7 fig, 2 tab, 15 ref, 1 append.

Descriptors: *Fish, *Surveys, *Atolls, *Aquatic animals, On-site investigations, Methodology, Reefs, Analysis, Saline water fish, Ecological distribution, Distribution patterns, Tidal waters, Data collections, *Canton Atoll, Fish fauna.

Inshore fishes at Canton were surveyed by visual sampling during a 2-week period in November and December 1973. Data from this survey expand the cumulative checklist for Canton Atoll fish species to 264 species from 50 families. The distribution of inshore fishes was analyzed from transect data, and 20 species were selected for representative distributional display. Several representative patterns of fish distribution emerge. Fish abundance (both individuals and species) is highest immediately outside and in the pass region. In the lagoon, abundance decreases with increasing distance from the pass. Fish transect and observational data were included in an appendix. (See also W79-06881) (Humphreys-ISWS)
W79-06886

MOLLUSCAN DISTRIBUTION PATTERNS AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
E. A. Kay.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 159-169, June 1976. 4 fig, 2 tab, 4 ref.

Descriptors: *Mollusks, *Atolls, *Aquatic animals, *Surveys, Gastropods, Distribution patterns, Lagoons, Tidal waters, Reefs, Ecological distribution, Data collections, Sampling, Methodology, On-site investigations, *Canton Atoll, Bivalves.

Micromollusks in sediment samples from Canton Atoll were described in terms of 3 assemblages: seaward reef; outer, clear water lagoon; and inner, turbid water lagoon. The seaward reef and outer lagoon assemblages are characterized by low standing crops, high species diversity, and a preponderance of microherbivores, in contrast to the inner lagoon, where there are higher standing crops, lower species diversity, and a strong tendency toward suspension feeding. The dominant gastropods in the lagoon are members of the family Diastomidae, including Diala flammea and species of Obtortio and Scaliola. The dominant bivalves are cardiids. The assemblages at Canton resemble those from Fanning Atoll in general aspects, such as standing crops, species diversity, and trophic structure, but differ noticeably in species composition. Differences in species composition are suggested to be associated with differences in water chemistry. (See also W79-06881) (Humphreys-ISWS)
W79-06887

OBSERVATIONS ON TERRESTRIAL SURFACES AND SUBSURFACE WATER AS RELATED TO ISLAND MORPHOLOGY AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
E. B. Guinther.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 171-183, June 1976. 2 fig, 2 tab, 4 ref.

Descriptors: *Surveys, *Water resources, *Atolls, Water quality, Geomorphology, Salinity, Water sampling, On-site investigations, Tidal waters, Tidal effects, Nutrients, Chlorophyll, Data collections, Groundwater, Lagoons, *Canton Atoll.

Reconnaissance sampling of isolated bodies of water on Canton Island revealed a pattern in salinities related to the physiography of the channels and flats of the island. Moderate salinities between 13 and 18 parts per thousand typified channelbed ponds, while lower salinities (less than 8 parts per thousand) typified potholes and water-filled burrows on the surrounding flats. Highest salinities (greater than 24 parts per thousand and up to 152 parts per thousand) were encountered in two larger ponds, in lagoon tidal channels, and in a saltern. A wide variation in concentration of nutri-

ents and chlorophyll a suggests ecological dissimilarities stemming either from salinity differences where such differences are great or from variations in biological community development owing to vagaries in colonization or previous environmental histories or both. (See also W79-06881) (Humphreys-ISWS)
W79-06888

TIME-STEPPING SCHEMES FOR FINITE ELEMENT TIDAL MODEL COMPUTATIONS,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray, and D. R. Lynch.
Advances in Water Resources, Vol. 1, No. 2, p 83-95, December 1977. 22 fig, 16 ref.

Descriptors: *Finite element analysis, *Tidal models, *Surface waters, Analytical techniques, Equations, Propagation factor.

A number of temporal procedures for solving the long-wave surface water equations using the finite element method in space are presented and analyzed. The analysis determines the stability of the schemes and the error in wave amplitude and phase that can be expected. The computational efficiency of the various methods is also discussed. The results of this analysis indicate types of errors that might be manifested in finite element surface water modeling using the different schemes. (Bell Graf-Cornell)
W79-06921

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH ON SALINE WATER CONVERSION BY FREEZING,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-197 790, Price codes: A05 in paper copy, A01 in microfiche.
OSW Research and Development Progress Report No 179, June 1966. 78 p, 27 fig, 5 tab, 29 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Freezing, Laminar flow, Membranes, Membrane processes, Crystal growth, Nucleation, Kinetics, Particle size, Additives, Ice-water interfaces, Saline water, Aqueous solutions, Diffusion, Flash freezing, Mass transfer, Heat transfer, Separation techniques, Water treatment, Water purification.

Progress in six areas of research on the desalination of aqueous solutions by freezing is summarized. The theoretical analysis of salt concentration build-up was extended to include laminar flow in round tubular membrane channels. It is concluded that for a reliable analysis it seems that the effluent concentration must be related to the membrane surface concentration. The study of the kinetics of ice crystal growth from supercooled water investigated whether small amounts of impurities added to the water altered growth kinetics. It was found that small concentrations of dissolved impurities in supercooled water do not greatly alter the kinetics of growth generally, but some concentrations of ammonium iodide and poly (acrylic acid) appear to reduce the growth velocity over the entire range of kinetics studied. The results and conclusions of previously published experimental work in washing brine from ice crystals are interpreted. The formation of ice crystal growth was studied in freezing saline water by direct contact with an immiscible refrigerant. An approximate theoretical analysis is presented for the influence of salt diffusion and of heat diffusion on the growth rate of ice crystals in undercooled saline water. Flash freezing of saline water and heat and mass transfer to small particles are two research programs still in their initial stages of development. (Davison-IPA)
W79-06570

MEMBRANE PHENOMENA,
Brooklyn Polytechnic Inst., NY.
H. P. Gregor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 208, Price codes: A06 in paper copy, A01 in microfiche.
OSW Research and Development Progress Report No 193, May 1966. 101 p, 34 fig, 10 tab, 55 ref. 14-01-0001-319.

Descriptors: *Membranes, *Desalination, *Desalination apparatus, Permselective membranes, Films, Polymers, Plastics, Cation exchange, Anion exchange, Permeability, Diffusion, Electrolytes, Physical properties, Chemical properties, Laboratory tests, Porosity, Hydraulic properties, Water treatment, Separation techniques.

Detailed information on the specific properties of ion exchange membranes is presented. Various cation exchange membranes containing the sulfonic acid group were subjected to immersion tests; equilibrium and kinetic studies were made. Mean activity coefficients, diffusion coefficients, selectivity coefficients, the rate of anion exchange and the hydraulic permeability of these membranes were determined. An experimental cell was designed for work to determine polarization. The experimental results for the specific properties of cation exchange membranes and ACl anion exchange membranes are tabulated. Results are presented for diffusion coefficient of DHO in membranes, activity coefficients in polyelectrolytes, diffusion coefficients in polyelectrolytes, and hydraulic permeabilities of membranes. The theoretical discussion includes information on the calculation of pore diameters in cation exchange membranes, and calculation of electrodialytic polarization. (Davison-IPA)
W79-06571

DESALINATION BY ELECTROSORPTION AND DESORPTION,
Southern Research Inst., Birmingham, AL.
R. E. Lacey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-210 527, Price codes: A03 in paper copy, A01 in microfiche.
OSW Research and Development Progress Report No. 195, June 1966. 77 p, 24 fig, 4 tab, 1 append. 14-01-0001-409.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Electrosorption, Membranes, Membrane processes, Demineralization, Electric currents, Electrodialysis, Fabrication, Costs, Economics, Separation techniques, Water treatment, Water purification.

Desalination experiments were conducted with two prototype electrosorption stacks to determine the effects of current density, feed concentration, flow rate of solution, and spacing between electrosorption membranes on demineralization performance. It was shown that, at current densities less than the limiting value, the coulomb efficiencies obtained in the electrosorption process are as high as in electrodialysis, and resistances per cell pair are about 30% lower than in electrodialysis. When current densities exceed the limiting current density, pH-sensitive salts precipitate within the electrosorption membranes; these precipitates are removed during desorption. Methods for fabricating electrosorption membranes were studied, and work in developing these membranes is continuing. The theory and mathematical expressions for the demineralization and regeneration phases have been extended. Calculations based on previous experimental data indicate that although 15 to 25% of the electrosorption process operation time is spent in membrane regeneration, the energy costs are about the same as for electrodialysis when treating the same type of water. It is further indicated that the total cost of desalination by electrosorption should be lower than that for electrodialysis because of lower capital costs. (Davison-IPA)
W79-06572

RESEARCH ON MINERAL BY-PRODUCTS FROM SALINE WATERS,
Grace (W. R.) and Co., Clarksville, MD.
M. L. Salutsky, J. Block, and M. G. Dunseth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-186 196, Price codes: A06 in paper copy, A01 in microfiche.
OSW Research and Development Progress Report No 197, September 1966. 177 p, 16 fig, 72 tab, 45 ref, 1 append. 14-01-0001-642.

Descriptors: *Desalination, *Pre-treatment(Water), *Phosphates, *Sulfates, *Potassium, *Economic feasibility, Sea water, Saline water, Water analysis, Water chemistry, Water treatment, Chemical precipitation, Chemical reactions, Separation techniques, Desalination plants.

Continuing research on the separation of mineral constituents from sea water and other saline waters is presented. Work is reported in the following areas: (1) recovery of potassium and sodium from saline waters by precipitation as a calcium double salt; (2) recovery of potassium from saline waters with iron and aluminum phosphate; (3) recovery of potassium from saline waters by precipitation with preformed magnesium ammonium phosphate; and (4) recovery of potassium from saline waters by precipitation with preformed magnesia alba. A process flowsheet for the recovery of potassium sulfate and sodium sulfates by calcium sulfate precipitation is provided. Cost estimates for this procedure show that a byproduct credit of $.20/1000 gallons of fresh water produced would be yielded from a 10 mgpd water conversion plant. The estimated manufacturing costs and byproduct values are tabulated. The price of chemical processing and the byproduct values are nearly the same for the recovery of potassium by the ferric phosphate process. (Davison-IPA)
W79-06573

STUDY AND ANALYSIS OF THE APPLICATION OF SALINE WATER CONVERSION PROCESSES TO ACID MINE WATERS,
Maryland Univ., College Park. Dept. of Chemical Engineering.
W. C. Schroeder, and J. M. Marchello.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 085, Price codes: A04 in paper copy, A01 in microfiche.
OSW Research and Development Progress Report No. 199, August 1966. 73 p, 11 tab, 23 ref. 14-01-0001-645.

Descriptors: *Desalination processes, *Acid mine water, *Water costs, *Capital costs, Operating costs, Ion exchange, Membrane processes, Distillation, Crystallization, Freezing, Effluents, Separation techniques, Water treatment, Waste water treatment, Water pollution treatment, Neutralization, Grassy Run(West Virginia), Kittanning Run(Pennsylvania).

An ion exchange process, two membrane processes, three crystallization and three distillation processes were examined to determine their potential application to acid mine waters. Water costs were determined for each process based on the total estimated capital and operating costs for various sized plants. Kittanning Run near Altoona, Pennsylvania, and Grassy Run near Elkins, West Virginia, were selected as feed to the plants. Except for ion exchange, all processes considered split the feed water into fresh water product and brine effluent which contains all the acid and iron present in the original feed water. Distillation, crystallization or the membrane processes can process acid mine water in its original condition or after it has been neutralized. The processing of acid water requires the use of more costly, acid resistant construction materials. Pre-treatment of the feed water by neutralizing it with sodium carbonate is favored for crystallization, membrane process, and distillation plants because of cost consideration. This neutralized water does not necessarily provide water suitable for domestic purposes. It is concluded that the saline water conversion processes considered would not be applicable to acid mine waters, except when a municipality's water supply needed augmentation with potable water meeting Public Health standards. (Davison-IPA)
W79-06574

ESIGN STUDY OF A REVERSE OSMOSIS LANT FOR SEA WATER CONVERSION,
General Atomic Co., San Diego, CA.
. T. Bray, and H. F. Menzel.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-176 288, rice codes: A06 in paper copy, A01 in microfiche. SW Research and Development Progress Report o. 176, April 1966. 98 p, 28 fig, 14 tab, 3 ref, 4 ppend. 14-01-0001-531.

escriptors: *Desalination, *Desalination plants, Desalination processes, *Desalination apparatus, Reverse osmosis, Membranes, Pilot plants, Eco-omics, Cost analysis, Estimated costs, Engineers stimates, Maintenance costs, Operating costs, apital costs, Design criteria, Separation tech-iques, Water treatment, Water purification, Sea ater, Brackish water.

s a first step in the engineering design of a everse osmosis pilot plant, a parametric study of a ne mgpd plant was undertaken to define system ressure, flow ratio between product water and rine stream, and the general flow arrangement ited for larger plant sizes. System parameters ere selected on the basis of economic consider-ions allowed by the technical aspects, and the nal selection criteria were the relative costs of ater between the systems having different param-ers. The costs were categorized as follows: nnual capital charges, pumping power, operation d maintenance, and membrane replacement. echnical and economic ground rules and assump-ons are discussed. The description of the one gpd plant includes plant layout and system subas-mblies. Capital and water costs for single and vo stage operations are tabulated. The engineer-g design of a gpd pilot plant based on data from e parametric study is presented in Part 2. The ant is a single stage unit with a 50,000 gpd roduct water capacity, a 2160 psi system design ressure, and a 1.0 brine to product water flow tio. The plant will require about 2400 modules ntaining six to seven sq ft of active membrane ea arranged in series of 20 inside 120 coated rbon steel pipes. Drawings and schematic dia-ams are included. (Davison-IPA)
/79-06575

ABRICATION AND EVALUATION OF NEW LTRATHIN REVERSE OSMOSIS MEM-RANES,
idwest Research Inst., Minneapolis, MN. North ar Research Div.
S. Francis.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-177 083, rice codes: A04 in paper copy, A01 in microfiche. SW Research and Development Progress Report o. 177, February 1966. 53 p, 14 fig, 14 tab, 16 ref. -01-0001-457.

escriptors: *Desalination, *Desalination appara-s, *Ultrathin membranes, Fabrication, Labora-ry testing, Polymers, Plastics, Distillation, Per-eability, Semipermeable membranes, Separation chniques, Water treatment, Water purification.

olymers with a broad range of chemical struc-res were used in devising methods to form ultra-in membranes. Membrane manipulation methods d testing procedures were developed which al-wed a large number of flux and desalination easurements to be made on membranes of esti-ated thicknesses between 1400 and 5000 ang-oms. Flux and desalination properties were de-rmined for ultrathin polymeric membranes con-ning the following groups: ester, ether and etal, nitrate ester, nitrile, urethane, chlorinated her, aromatic and hydroxyl. Except for chlorin-ed polyether, all were permeated by water and jected significant portions of salt. Annealing, sol-nt vapor exposure, membrane drying, and partial ractionation were investigated as treatments to crease membrane permeability or salt rejection. he results showed wide ranges of permeability d salt rejection, but as one property improved, e other suffered. Data obtained from infrared ectra of annealed and unannealed membranes d an X-ray pattern from a multilayered annealed cellulose acetate specimen are being analyzed. Results of these investigations indicate that the ultrathin membrane is a feasible approach for the study of film morphology and desalination mechanisms, and that the ultrathin membrane would be amenable to commercial production. (Davison-IPA)
W79-06576

RESEARCH ON SALINE WATER CONVERSION BY FREEZING AND REVERSE OSMOSIS,
Massachusets Inst. of Tech., Cambridge.
T. K. Sherwood, P. L. T. Brian, and A. F. Sarofim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 205, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 180, May 1966. 85 p, 27 fig, 6 tab, 28 ref, 2 append. 14-01-0001-546.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Freezing, Polarization, Mass transport, Membrane processes, Flow, Laminar flow, Turbulent flow, Nucleation, Crystal growth, Ice-water interfaces, Evaporation, Particle size, Light penetration, Separation techniques, Water treatment, Water purification.

Progress in seven areas of investigation is reported. Results of experimental studies of concentration polarization at a membrane surface in forward and reverse osmosis substantiate earlier theory and further clarify the understanding of the mechanism of salt and water transport through cellulose acetate membranes. Results of previously published theoretical analysis were used to present concentration polarization ratios for reverse osmosis systems operating at a variety of conditions including laminar and turbulent flow in tubular membranes. Progress in a preliminary study of the nucleation and growth of ice crystals in direct contact cooled brine with iso-butylene is summarized. Quantitative results have not yet been obtained in the investigation of the growth of ice across the surface of a pool of water subcooled by the continuous evaporation of water from the surface. The use of light transmission measurements to measure ice particle size and concentration is discussed. This technique is advantageous because it causes a minimum disturbance to the system studied, and the photocells provide an instantaneous record of the changes in particle size and concentration. The initial steps in establishing work on heat and mass transfer to small spheres in turbulent suspension are discussed. A proposed program for washing brine from ice crystals will be in two parts: experimental and theoretical. (Davison-IPA)
W79-06577

INVESTIGATION OF CALCIUM SULFATE PRECIPITATION,
Monsanto Research Corp., Everett, MA.
B. M. Fabuss, A. S. Borsanyi, and C. H. Lu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 206, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 183, May 1966. 45 p, 17 fig, 8 tab, 3 ref. 14-01-0001-465.

Descriptors: *Chemical precipitation, *Calcium sulfate, *Solubility, *Laboratory tests, *Sealing, Fouling, Heat transfer, Equilibrium, Rates evaporation, Temperature, Laboratory equipment, Research and development, Separation techniques, Desalination, Desalination apparatus, Water treatment.

An investigation was undertaken to obtain basic information on the equilibria and rate processes controlling calcium sulfate precipitation which fouls heat transfer surfaces in many desalination processes. Constant volume heating and constant temperature evaporation experiments were conducted by precipitating calcium sulfate from distilled water. The laboratory equipment consisted of an autoclave, sampling filter system, condenser and receivers, and associated instrumentation. The concentration range in the volume heating experiments was 400 to 2000 ppm with an equilibrium temperature range of 90 to 155C. A temperature range of 80 to 180C with initial concentrations of 100 to 1020 ppm and an evaporation ratio of 2.3 to 4.1 were used in the constant temperature evaporation experiments. In both types of experiments a break point was observed in the conductivity versus temperature curve at constant concentration, or in the conductivity versus concentration curve at constant temperature. These break points occurred between the solubility curves of the hemihydrate and anhydrite modifications. Precipitation started after the break point; the concentration of the solution did not reach or exceed solubility values corresponding to the hemihydrate solubility curve. For the temperature range, 100 to 180C, the precipitation of calcium sulfate from distilled water was controlled by the solubility curve of anhydrite; precipitation with respect to anhydrite was slow process. (Davison-IPA)
W79-06578

DESIGN AND CONSTRUCTION OF A DESALINATION PILOT PLANT, (A REVERSE OSMOSIS PROCESS).
Aerojet-General Corp., Azusa, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 574, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 86, January 1964. 61 p, 19 fig, 2 append. 14-01-0001-296.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Laboratory equipment, *Membranes, *Fabrication, Evaluation, Laboratory tests, Adhesives, Sodium chloride, Aqueous solutions, Corrosion, Desalination apparatus, Separation techniques, Water treatment, Water purification, Sea water, Brackish water, Pilot plants.

A 1000 gpd pilot plant was designed, fabricated, and assembled in an evaluation of the reverse osmosis process for desalination of brackish and sea water. Membrane fabrication techniques and equipment are described. Of the two techniques used to evaluate the membranes, the dye test was rejected on the basis of the equipment and time involved; a random sampling and testing of 10% of a day's membrane production has been used with good results. Feed water compositions of 0.5%, 1.5% and 3.5% sodium chloride were used in operating tests. In many tests operation was continuous for four days at constant operating conditions. A total of 1100 gallons of product containing less than 400 ppm dissolved solids was produced during one 24 hours test with a 0.5% sodium chloride solution. Preliminary attempts to reduce corrosion, which had become an operating problem, were partially successful. The design of the bench scale appratus followed the laboratory equipment as closely as possible, but included novel features not used in the laboratory. Several different designs for desalination cells and membrane configurations were fabricated and tested on this apparatus. The results of this work indicate that some of the concepts will yield a more economical cell design. (Davison-IPA)
W79-06579

FIRST ANNUAL REPORT: SALINE WATER DEMONSTRATION PLANT NO. 2, SAN DIEGO, CALIFORNIA.
Burns and Roe, Inc., Hempstead, NY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 684, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 102, February 1964. 194 p, 48 fig, 20 tab, 7 append. 14-01-0001-233.

Descriptors: *Desalination, *Desalination plants, *Demonstration Plant No 2, *Flash distillation, *Desalination processes, *Costs, Capital costs, Operating costs, Water costs, Maintenance costs, Water quality, Separation techniques, Water treatment, Scaling, Corrosion, Vegetation effects, Marine plants, Tubes, Water purification, San Diego(California), Sea water.

Group 3A—Saline Water Conversion

A technical and operational evaluation of the flash distillation process as employed by Demonstration Plant No. 2 at San Diego, California is reported for the period March 1962 through June 1963. During the first year of operation, mechanical difficulties caused only the normal interruption expected in new plants. Plant downtime was principally caused by clogging of the intake screens, condenser tubes, and tube sheets by marine vegetation. Some success was achieved through modifications to the equipment, but stoppage due to clogging remains the critical problem. Raising the distillation temperature increased the plant production, and although less corrosion and scaling were found than expected at the higher temperatures, the length of time in service was too short for these observations to be significant. During the period 347,000,000 gallons of high quality fresh water containing 5 ppm of dissolved solids have been delivered to the city of San Diego. Demonstration plant capital, operating, and maintenance costs are tabulated, and theoretical costs for a normalized plant are discussed. Although the major problems of scaling and high temperature operation have been overcome, long-term corrosion rates for the various types of metal tubing have not been determined. The copper alloy and carbon steel tubes appear in good condition. It is concluded that large scale plants of this type are economically attractive. Schematic drawings of the plant are provided. (Davison-IPA)
W79-06580

SEPARATIONS PROCESSES,
Oak Ridge National Lab., TN.
J. S. Johnson, Jr., and K. A. Kraus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 921, Price codes: A11 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 508, February 1970. 231 p, 90 fig, 22 tab, 481 ref. 14-01-0001-937.

Descriptors: *Desalination, *Desalination processes, *Filtration, *Reverse osmosis, *Membrane processes, Membranes, Boundary layers, Polarity, Ion exchange, Mass transport, Adsorption, Heat transfer, Separation techniques, Water treatment, Water purification, Desalination apparatus.

Work on transport through membranes and across phase boundaries, and on ion exchange is reported in the third volume of the second biennial report on the activities of the Water Research Program at Oak Ridge National Laboratory. Altogether 21 papers are presented covering the following areas: salt filtration by charged microporous solids; hyperfiltration (reverse osmosis); concentration polarization; boundary layer studies; detachable membranes; dynamically formed membranes; and ion exchange. Of the 14 articles published in the open literature, one, 'Review Article on Hyperfiltration' has appeared as a chapter in the book 'Principles of Desalination'. There are 290 references for this article. (Davison-IPA)
W79-06581

SECOND ANNUAL REPORT, BRACKISH WATER CONVERSION DEMONSTRATION PLANT NO. 4 ROSWELL, NEW MEXICO.
American Hydrotherm Corp., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-193 147, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 170, May 1966. 184 p, 45 fig, 22 tab, 23 ref, 7 append. 14-01-001-322.

Descriptors: *Desalination, *Desalination plants, *Demonstration Plant No 4, *Forced circulation vapor compression distillation, Capital costs, Operating costs, Operation and maintenance, Evaporators, Distillation, Scaling, Ion exchange, Equipment, Brackish water, Roswell(New Mexico).

A technical evaluation of the maintenance and repair work done and the development work carried out at the Roswell vapor compression distillation plant, New Mexico, is reported for July 1, 1964 through June 30, 1965. The plant was in actual operation only 21.3% of the scheduled time and produced 53.5 million gallons, averaging 750,000 gpd. Repairs and maintenance were necessary on all equipment. The compressor and its motor accounted for 50% of the downtime; major reconstruction of the ion exchange system was required. Developmental work was carried out on the ion exchange system, the deaeration system, and the evaporator system. The evaporator system studies related to velocity distribution, concentration studies of blowdown and the concentration that should provide scale free operation (3:1); scale composition at 4:1 concentration; additives for scale prevention; and the flow rate of the circulating pumps. Demonstration plant capital and operating costs, and theoretical capital and operating costs for a normalized plant are presented in addition to monthly production and cost figures. It is concluded that the plant is capable of producing one million gallons/day; that it is capable of scale free operation at a concentration factor of 3 to 1; and that its ion exchange system is capable of working mostly with blowdown introducing only a small amount of purchased salt. (Davison-IPA)
W79-06582

A STUDY OF REVERSE OSMOSIS SYSTEMS FOR DESALINATION,
Syracuse Univ., NY.
W. N. Gill, C. Tien, and D. W. Zeh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 207, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 185, May 1966. 33 p, 10 fig, 2 tab, 7 ref. 14-01-0001-401.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, Flow, Performance, Diffusion, Equations, Boundary layers, Pressure, Velocity, Separation techniques, Water treatment, Water purification.

Continuous constant pressure reverse osmosis two-dimensional flow systems are analyzed, so that system performance is predicted in terms of operating variables. Therefore, the solution of the nonlinear diffusion equation employs nonlinear boundary conditions, and a series solution, accounting for nonlinearities in both the diffusion equation and its boundary conditions, is developed. Only wedge type flows are considered for boundary layer flows with pressure gradient, and the analysis is applicable to fully developed flows and entrance region flows. Numerical results are generalized, and some specific data are reported for systems similar to those used in practice. (Davison-IPA)
W79-06583

DESIGN AND SPECIFICATION BID PACKAGE FOR A 2500 GPD EUTECTIC FREEZING PILOT PLANT.
Fluor Engineers and Constructors, Inc. Irvine, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 916, Price codes: A08 in paper copy, A01 in microfiche. Report, March 1979. 127 p, 3 drawings. OWRT C-80132-S(8518)(1). 14-34-0001-8518.

Descriptors: *Freezing process, Thermal process, *Desalination, Brine.

A technical specification bid package for a 2500 gallon per day (GPD) eutectic freeze pilot plant was prepared. The package includes process and mechanical flow diagrams and plot plan of the pilot plant, as well as general project information and specific design criteria for the plant. The eutectic freezing pilot plant is designed to desalinate a brine feedwater, by producing ice and salt. A brine solution is fed into the freezer tank from which heat removal is accomplished by direct contact evaporation of refrigerant, R-114. Solids, ice and dihydrate salt, and a eutectic solution of brine are produced. A hydrocyclone is used to separate the heavier salt from the ice. Solid salt is removed from the brine solution in a filter. Ice is removed from the brine solution in drain and wash columns. Ice from the top of the wash column is repulped with product water to form a slurry which is fed to the melter/condenser. The ice is melted to form product water and in turn the compressed R-114 vapors from the freezing tank are condensed. Because of process inefficiencies and heat leaks into the process, the quantity of ice produced is not sufficient to condense all the refrigerant vapors. Make-up refrigerant is provided with a packaged refrigeration unit.
W79-06858

FINAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY - CONTRACT NO. 14-34-0001-7513.
Membrane Systems, Inc., San Diego, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 046, Price codes: A04 in paper copy, A01 in microfiche. February 1979. 55 p, 10 fig, 8 tab. OWRT (7513)(1). 14-34-0001-7513(1).

Descriptors: *Low pressure membrane, *Composite membrane, Brackish water, Spiral wound elements, Desalination processes, Reverse osmsosis, Membranes processes.

In Phase I, low pressure, composite membrane was developed for the desalination of brackish waters. The membrane barrier layer was formed by the interfacial polycondensation of polyethyleneimine and isophthaloyl chloride on polysulfone porous support. The polysulfone porous support was cast on a non-woven polyester fabric. The membrane has a flux of 20-22 GFD and a rejection of 97% or better when operated on a feedwater at 250 PSIG containing 5,000 mg/l of sodium chloride at 75F. In Phase II, 6 spiral wound reverse osmosis elements with nominal dimensions of 2 inches in diameter and 12 inches in length were fabricated, tested and shipped to the Roswell Test Facility. In Phase III, 6 spiral wound reverse osmosis elements with nominal dimensions of 4 inches in diameter and 12 inches in length were fabricated, tested and shipped to the Roswell Test Facility.
W79-06891

3B. Water Yield Improvement

THE DEVELOPMENT OF ORGANIC ICE NUCLEI GENERATORS FOR WEATHER MODIFICATION,
Denver Research Inst., CO. Cloud Physics Lab.
For primary bibliographic entry see Field 2B.
W79-06765

POTENTIAL FOR AUGMENTING FLOW OF THE COLORADO RIVER BY VEGETATION MANAGEMENT,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
A. R. Hibbert.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson, Arizona, Arizona Water Commission Report No. 10, p 16-21, (1977). 5 tab.

Descriptors: *Colorado River Basin, *Vegetation effects, *Flow augmentation, *Watershed management, *Water yield improvement, *Forest management, *Evapotranspiration control, Rainfall-runoff relationships, Snow management, Water conservation, Environmental effects, Evaporation control, Sublimation, Streamflow, Surface runoff, Clearcutting, Cost analysis, Streamflow forecasting.

Building on the acknowledged premise that streamflow in the Colorado River Basin will be insufficient to meet all future demands anticipated from rapid growth in the region and the requirements of energy development, this study seeks to set forth some theoretical watershed management practices that might reduce evaporative loss and thus increase water yield in the Basin. Water yield response to various treatment practices was determined for 11 vegetation types (excluding phreatophytes) on lands in all ownerships in both Upper and Lower Basins, occupying some 76 million acres, or one-half the total Basin. Results of such

rials indicate that one-half million acre-feet of xtra water could be obtained from the Upper Basin by committing up to 22% of each vegetation ype except aspen forest by 80-year rotation clear-ut harvest in patches; in the Lower Basin, more xtensive treatments would be required to generate quarter of a million acre-feet of extra water. Disregarded in these choices are knowledge of vailability of treatable acreage and economic feas-ility, whereas in actual practice economic factors ill strongly influence priorities of treatment, as ill the complex and difficult matter of public cceptance of water yield improvement theories. Paylore-Arizona)
V79-06833

ORMATION FINES AND FACTORS CON-ROLLING THEIR MOVEMENT IN POROUS IEDIA,
xxon Production Research Co., Houston, TX.
or primary bibliographic entry see Field 2F.
79-06864

C. Use Of Water Of Impaired Quality

VAPOTRANSPIRATION BED DESIGN,
oodson (Raymond L.) Inc., Dallas, TX.
or primary bibliographic entry see Field 2D.
79-06748

ONTROLLED DEGRADATION AND/OR ROTECTION ZONES--NONSENSE,
cience and Education Administration, Phoenix, Z. Water Conservation Lab.
or primary bibliographic entry see Field 5G.
79-06902

E. Conservation In Industry

ECYCLING OF WATER IN POULTRY PROC-SSING PLANTS,
anford Research Inst., Menlo Park, CA.
J. Rogers.
vailable from the National Technical Information rvice, Springfield, VA 22161 as PB-280 720, ice codes: A03 in paper copy, A01 in microfiche. terim Technical Report No. EPA-600/2-78-039, arch 1978. 38 p, 6 fig, 12 tab, 1 append. S-800930.

escriptors: *Water reuse, *Water pollution treat-ent, *Waste water treatment, *Food processing dustry, *Poultry, *Recirculated water, Water nservation, Waste water(Pollution), Microorgan-ns, Light, Ultraviolet radiation, Water quality ntrol, Filtration, Filters, Diatomaceous earth, perating costs, Cost comparisons, Bacteria, Ef-ents, Refrigeration, Water cooling, Solid wastes, lorides, Coliforms, Activated carbon, Centrifu-tion, Biochemical oxygen demand.

esults are reported of pilot scale studies on treat-g water for recycle in the chiller used in poultry ocessing. To ensure a sanitary product, the SDA requires a half gallon of water/bird in the iller system. A recycling system for maintaining uivalent water quality at reduced flow must be pable of removing solids and controlling micro-l population. For ultraviolet light, used to con-l the microbial population, to be effective suffi-nt solids must be removed to allow light trans-ssion. The removal methods studied include: (1) clonic desludgers, (2) vibrating screens, (3) flota-n cells, (4) centrifugal waste concentration, (5) ration with diatomaceous earth (DE) filter aid, d (6) activated carbon. Results showed that DE ration was most feasible and that it maintained cterial level equivalent to that in a comparable nrecycle system. New water requirements/bird reduced from 0.5 gallons to 0.2 gallons. Operat-costs for the DE filtration system using 30 lons of ice/minute are $79.06/day. Operating st of the chiller without recycle are $146.90/day. avison-IPA)
79-06953

3F. Conservation In Agriculture

POWER TRANSMISSION FOR SELF-PRO-PELLED IRRIGATION SYSTEM,
Toro Co., San Marcos, CA. (Assignee).
E. J. Hunter, and R. E. Hunter.
U.S. Patent No. 4,133,344, 7 p, 7 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 978, no 2, p 474, January 9, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation practices, *Irrigation efficiency, Application equipment, Center pivot irrigation system, Transmission, Self-propelled equipment.

A self-propelled center pivot irrigation system has individual span units each one of which has at least one or more fluid conduits, and at least one or more power frames for propelling the span unit. Each power frame has at least one or more drive wheels, a drive motor, and transmission means connecting the drive motor to the drive wheels. The transmission has an input drive gear, intermediate planetary gear speed reduction means and an output shaft for connection between the drive motor output shaft and the power frame drive wheels to provide a low friction, speed reducing, torque increasing drive for the power frame drive wheels from the drive motor. (Sinha-OEIS)
W79-06630

IRRIGATION LINE MOVER,
Crown American Irrigation, Inc., Eugene, OR. (Assignee).
P. E. Batson.
U.S. Patent No. 4,134,422, 5 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 3, p 845, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Pipes, Application equipment, Mechanical equipment, Line mover.

An improved irrigation line mover is disclosed in which a line mover carried an engine rotating an irrigation pipe supported by wheels keyed to the pipe. The engine also drives wheels of a cart-like carriage of the line mover through reversible one-way clutches. Each clutch includes a sprocket keyed to an axle keyed to cart wheels and a lever-like pawl held by a spring extending around the axle in either an only forward driving position relative to the sprocket or an only reverse driving position relative to the sprocket. (Sinha-OEIS)
W79-06635

LIQUID FLOW CONTROL DEVICE,
E. M. Bright.
U.S. Patent No. 4,134,550, 9 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 891, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation efficiency, *Irrigation practices, *Flow control, Application equipment, Valves, Water pressure, Drip irrigation, Emitters.

A low cost valve, such as an emitter for controlling the flow from an aperture in a drip irrigation pipe, operates dynamically to maintain flow substantially constant across a wide range of pressures. A cylindrical valve seat mounted within the pipe aperture receives a valve member having a coaxial stem portion that extends through the valve seat to couple an external cap member. The interior end of the valve member comprises a diverging cone defined by integral and circumferentially separated leaf elements that engage a bearing surface of the valve seat at a root circumference when unstressed. Increasing water pressure within the pipe acts against the interior of the cone surface, distorting the leaf elements inwardly a proportional amount and shifting the valve member relative to the bearing surface through a selected limited operating range. The effective apertures between the leaf elements increase in length but decrease in width with greater pressure, providing an increasing impedance that maintains flow rate constant. The leaf elements are of selected stiffness and of relatively low friction material, and assume a stable pressure responsive position whether pressure is increasing or decreasing. The apertures between the leaf members are further shaped to provide an automatic purging flow when the pressure increases to or above a selected maximum. (Sinha-OEIS)
W79-06636

EMITTER FOR DRIP IRRIGATION,
D. G. Zeman.
U.S. Patent No 4,134,551, 8 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 891, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation efficiency, Irrigation practices, Flow control, Application equipment, Tubes, Closed conduits, Drip irrigation, Emitters.

A desirable emitter for use in drip irrigation can be constructed so as to utilize an elongated member formed of a flexible, resilient material so as to include at least one and preferably a number of internal ribs or projections which prevent the interior of the member from being closed off or pinched shut as it is deformed or flexed. Such a member is normally mounted so as to extend into an enclosed space such as the interior of an irrigation tube or conduit in such a manner that water can flow from the interior to the exterior of the space through the member. The liquid within the space can be controlled so as to exert a force against the exterior of the emitter causing it to be deformed or flexed in such a manner as to vary the flow through the member. (Sinha-OEIS)
W79-06637

WATER BALANCE IN IRRIGATED SOILS,
Academia de Stiinte Agricole si Silvice, Bucharest (Romania).
M. Botzan, and O. Merculiev.
ICID Bulletin (International Commission on Irrigation and Drainage), Vol. 27, No. 2, p 23-29, 35, July, 1978. 26 ref.

Descriptors: *Water balance, Irrigation design, Irrigation programs, *Consumptive use, Soil-water-plant relationships, Leaching, Evapotranspiration.

The paper presented the results obtained by land experimental research works carried out in different pedoclimatic zones of Romania (temperate zone) between 1945-1947 and continuously since 1951. The water balance elements (initial reserve, final reserve, winter and summer precipitations, groundwater supply, soil water consumption on different calculated probabilities on crops and pedoclimatic zones, the water application and the irrigation rates during the vegetation and supply periods) were quantitatively characterized. Interrelationships of water consumption with the type of crop and pedoclimatic zone, soil humidity, air temperature, and crop yield were established. These correlations allowed for establishing an indirect water-consumption calculation method. For the irrigation project designing model, the basic elements and the limitative conditions were established. Both the irrigation as required and irrigation by rotation were analyzed for the water application forecast and programming. Also, the basic participating elements of the model in the prognosis stage were established together with the limitative conditions which determine the water application program in the row of plots irrigated in a single rotation. (Skogerboe-Colorado State)
W79-06647

DESCRIBING IRRIGATION EFFICIENCY AND UNIFORMITY.
American Society of Civil Engineers, New York. Irrigation and Drainage Div.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 104, No IR1, p 35-41, March 1978. 3 fig, 6 equ, 11 ref.

Descriptors: *Irrigation efficiency, *Water distribution(Applied), *Surface irrigation, *Uniformity, Sprinkler irrigation, Trickle irrigation, Soil moisture, Equations, Mass balance, Infiltration, Depth.

To help standardize system design and evaluation terminology, a limited number of the more essential terms defining efficiency of water application and distribution by irrigation systems are presented. These definitions have been formulated to minimize conflict with common usage or existing glossaries. Where methods of evaluating the terms are not obvious, suggestions have been presented and the utility of the terms in irrigation system design or evaluation has been discussed. Application of the terms to some of the newly developing methods of irrigation has also been considered. (Bell-Graf--Cornell)
W79-06648

TRICKLE IRRIGATION UNIFORMITY AND EFFICIENCY,
Rain Bird Technical Services, Glendora, CA.
K. Solomon, and J. Keller.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 104, No IR3, p 293-306, September 1978. 5 fig, 1 tab, 16 equ, 8 ref.

Descriptors: *Irrigation efficiency, *Trickle irrigation, *Application methods, *Emission standards, *Uniformity, Design, Networks, Histograms, Flow rate, Manifolds, Equations, Pressure distribution, Effects, Sloping terrain.

Expressions are developed and presented for the pressure head available at any point within a trickle irrigation subunit. Histograms are drawn showing the distributions of pressure within typical subunits. Distributions of emitter flow rates within typical subunits are derived from considerations of the effects of pressure differentials and manufacturing variations in emitter characteristics. The coefficient of equations and distributions developed are used to complete tables giving the emission uniformity and efficiency of systems for various combinations of design and equipment characteristics. (Bell-Graf--Cornell)
W79-06649

LEACHING CONTROL CAN'T BE PERFECT,
R. Larsen.
Irrigation Age, Vol. 13, No. 2, p. 49, October, 1978. 1 fig.

Descriptors: *Leaching, Leachate, *Nitrogen, Nitrates, Irrigation, Scheduling, Nebraska.

This article reported the study to minimize losses from leaching conducted on sandy soils by some members of the Agricultural Engineering Department, University of Nebraska-Lincoln. The major conclusion of the study was that scheduling of irrigations to minimize percolation and proper selection of nitrogen (N) amount and source can have a significant effect on nitrate leaching loss when corn is produced on sandy soils. The study, however, indicated that reducing the loss to zero is not a practical goal on sandy soils. (Skogerboe-Colorado State)
W79-06695

REMOTE SENSING FOR AGRICULTURAL WATER MANAGEMENT AND CROP YIELD PREDICTION,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
S. B. Idso, R. D. Jackson, and R. J. Reginato.
Agricultural Water Management, Vol. 1, No. 4, p 299-310, December, 1978. 5 fig, 32 ref.

Descriptors: *Remote sensing, Water management(Applied), Crop production, Scheduling, Irrigation, Albedo, Soil moisture, Evaporation.

This paper reviewed the research conducted at the U.S. Water Conservation Laboratory, Phoenix, Arizona over the past several years relative to agricultural application of remote sensing. In addition, new data were presented. The subjects treated were soil moisture, evaporation, irrigation scheduling, and crop yield estimation. The analyses indicated that the technology is available to successfully integrate remote sensing techniques into agricultural operations designed to enhance production via intelligent water management. (Skogerboe-Colorado State)
W79-06698

MINIMIZING SALT IN DRAIN WATER BY IRRIGATION MANAGEMENT--DESIGN AND INITIAL RESULTS OF ARIZONA FIELD STUDIES,
Science and Education Administration, Riverside, CA. Salinity Lab.
G. J. Hoffman, C. Dirksen, R. D. Ingvalson, E. V. Maas, and J. D. Oster.
Agricultural Water Management, Vol. 1, No. 3, p 233-252, November, 1978. 11 fig, 3 tab, 19 ref.

Descriptors: Water management(Applied), *Salinity, *Drainage water, *Leaching, Return flow, Evapotranspiration, Oranges, Alfalfa, Arizona.

Two field experiments were established in the Wellton-Mohawk Irrigation and Drainage District of southwestern Arizona to test the feasibility of decreasing the salt load in drainage water by reduced leaching. Results were given for the initial 2 years of the test for Valencia orange trees and the first year for alfalfa. The water application data, substantiated by salinity sensor readings and measures of soil chloride, indicated that the annual evapotranspiration of Valencia orange was approximately 1375 mm on a total area basis. After 2 years, fruit yield and quality and tree growth were not significantly different from flood-irrigated trees that received 40% more water. It was concluded that if these results persist, the salt load from citrus in the district could be reduced 40,000 Mg annually by reduced leaching. More importantly, because of the salinity of the groundwater pumped for water table control the salt load exported from the district could be reduced initially by 130,000 Mg annually. Results indicate that the alfalfa experiment was underirrigated the first year and evapotranspiration was about 1950 mm annually. Comparisons indicated that the level basin flood irrigated check yielded 20% more than the experiment and had about 10% leaching, an efficiency that can probably not be improved. (Skogerboe-Colorado State)
W79-06700

LEARNING TO IRRIGATE...WITH 5000 TENSIOMETERS,
C. Henry.
Irrigation Age, Vol 13, No 3, p 6-8, November-December, 1978. 4 fig.

Descriptors: Tensiometers, *Irrigation scheduling, Idaho.

This article reports the experience of an irrigation consultant with the use of tensiometers for irrigation scheduling. (Skogerboe-Colorado State)
W79-06701

CHEMICAL INJECTION POPULAR IN NORTHWEST,
C. Henry.
Irrigation Age, Vol 13, No 3, p 46-47, November-December, 1978. 3 fig.

Descriptors: *Irrigation, *Fertilizers, Fertilization, Chemicals, Sprinkler irrigation, Application methods, Application equipment, Injection.

This article reports and discusses the methods and benefits of applying liquid chemicals and fertilizers with irrigation water. (Skogerboe-Colorado State)
W79-06702

BEST USE OF CROP RESIDUES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
C. R. Fenster, R. H. Follett, and E. J. Williamson.
Crops and Soils Magazine, Vol 30, No 9, p 10-13, August-September, 1978. 3 fig, 2 tab.

Descriptors: Feeds, Crops, *Organic matter, Soil erosion.

Present and some potential uses of crop residues are described. The best use of crop residues depends on the crop, the soil, the location, and a number of other problems directly and remotely related to agriculture. (Skogerboe-Colorado State)
W79-06704

CHOICES IN IRRIGATION MANAGEMENT,
ICID Bulletin, (International Commission on Irrigation and Drainage). Vol. 27, No. 2, p 62-64, July, 1978.

Descriptors: Groundwater, *Irrigation programs, Pricing, Crop production.

A workshop on choices in irrigation management was organized by the Agricultural Administration Unit of the Overseas Development Institute and held at the University of Kent, Canterbury. The workshop was attended by 35 participants, of whom 12 came from eight different countries in Asia, Africa and Latin America. The majority of these had extensive first-hand experience of irrigation management at project level. Twenty-one papers were presented and discussed. This paper is a summary of these 21 papers discussed under several categories of irrigation management. (Skogerboe-Colorado State)
W79-06710

SOME PROPOSITIONS ABOUT IRRIGATION PROJECT AND SYSTEM MANAGEMENT,
Overseas Development Inst., London (England).
A. F. Bottrall.
ICID Bulletin, International Commission on Irrigation and Drainage. Vol. 27, No. 2, p 68-72, July, 1978. 1 tab.

Descriptors: *Irrigation programs, Agriculture, Decision making, Project planning, Crop production.

This is a modified version of a paper presented at the Overseas Development Institute Workshop on Choices in Irrigation Management, held from 27 September-1 October, 1976 at the University of Kent, Canterbury, (U.K.). The object of this paper is to put forward some generalized propositions about certain aspects of irrigation management in developing countries on which, whatever the characteristics of a particular project or system may be, strategic decisions will at some point have to be made. The propositions are concerned primarily with projects dependent on surface water delivery systems. The propositions are derived primarily from observations made during field research in North West India and from the desk review of case studies in other parts of the developing world. The first set of propositions is concerned with the broader aspects of project organization and management, the second set with more detailed aspects of water delivery system design and operations. But there is clearly a large degree of interdependence between propositions in each set. (Skogerboe-Colorado State)
W79-06711

WATER BALANCE OF FLOODED RICE PADDIES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 2I.
W79-06713

HARVESTING RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4A.
W79-06734

A SOIL-WATER-NITROGEN MODEL FOR IRRIGATED CORN ON SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2K.
W79-06736

WATER HARVESTING AGRISYSTEM TO GROW JOJOBA ON DEVELOPED IDLE FARMLAND,
Arizona Water Resource Research Center, Tucson; and Arizona Univ., Tucson. Office of Arid Lands Studies.
J. B. Cluff, and K. E. Foster.
Arizona Water Resources News Bulletin, No. 78-1, Jan.-April 1978. 3 fig, 2 tab.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Water yield improvement, *Jojoba, Surface sealing, Arid climtes, Water conservation, Sodium Chloride, Weed control, Reservoir storage, Computer analysis, Root zone, Infiltration, Agricultural production, Crop response, Arizona.

Recognizing the present groundwater overdraft of most of Arizona's basins, the University of Arizona Water Resources Research Center in cooperation with the Dept. of Soils, Water and Engineering, has developed a water harvesting agrisystem to rehabilitate abandoned farmland, designed to operate without groundwater. For descriptive purposes the system is applied to jojoba as a cash crop on a 5-acre area in the Avra Valley, Arizona. Based upon a similar system at Page Ranch, north of Tucson, where a one-acre plot has been used for the past several years to grow grapes, the present project involves the reshaping of farmland into a large and runoff configuration which is treated with sodium chloride to increase runoff and reduce weed and dust control costs. Rainwater is expected to run from the ridged portion into adjacent drainages planted with jojoba, with excess runoff being collected and pumped to a compartmented reservoir for plant use as needed during peak-production low-precipitation periods. The system design parameters were tested by computer analysis based on 31 years of daily rainfall and runoff records for the test area. Three simulations were made using different root-depth and infiltration-width data. Results indicated that as jojoba plants grow, larger amounts of water can be stored in the soil and lesser amounts in the compartmented reservoir although the reservoir appears to be essential to maximize production. Estimated costs to establish and maintain one plantation acre of jojoba for the three years before bean yield are $1,638 per acre. (Hickes-Arizona)
W79-06846

REDUCING SALT PICKUP FROM IRRIGATED LANDS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker, G. V. Skogerboe, and R. G. Evans.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR1, p 1-14, March 1979. 5 fig, 16 ref.

Descriptors: *Irrigation efficiency, *Automation, Salinity, *Water quality control, *Optimization, Cost minimization, *Model studies, Colorado River, Desalination, Return flow, Seepage, Drainage, Furrow irrigation, Sprinkler irrigation, Trickle irrigation, Equations, Systems analysis, Agriculture, Treatment model, Canal linings, Cost effectiveness.

Reducing the contribution of irrigated agriculture to the problem of salt loading in a major river basin is described in both a conceptual and mathematical context. The array of alternative solutions is primarily structural in nature and are oriented towards reducing salt pickup resulting from inefficient irrigation practices. The optimization of salinity control strategies involves combining the best features of several control measures. Consequently, the analyses described are based on finding the minimum cost solution to a salinity control problem involving a specified goal for salt load reduction. The multilevel optimization method involves two models: (1) an agricultural model divided into a water conveyance subsystem and an on-farm subsystem; and (2) a treatment model. (Bell Graf-Cornell)
W79-06937

AIR CHAMBERS FOR IRRIGATION SYSTEMS,
Bookman and Edmonston, Glendale, CA.
G. E. Conant, and D. E. Jaspar.
Journal of the Transportation Engineering Journal, Proceedings of the American Society of Civil Engineers, Vol. 105, No. TE2, p 141-148, March 1979. 4 fig, 2 tab, 1 ref.

Descriptors: *Irrigation systems, *Air chambers, *California, *Droughts, *Water distribution(Applied), *Wells, *Water hammer, *Pipelines, Agriculture, Groundwater, Irrigation, Hydraulics, Hydrodynamics, Pumping.

The 1977 drought was the most severe in California's history. The California Water Project was able to deliver only about 30% of the water demands for the calendar year 1977. The Wheeler Ridge-Maricopa Water Storage District receives its water from the California Water Project and, therefore, the District was able to provide only 30% of the farmer's water needs in 1977. The District, in an effort to alleviate the effects of the drought, allowed private wells to be connected into the District's distribution system. The existing distribution systems were not designed to accommodate such connections and the resulting hydraulic pressures within the distribution system were of concern to the District. In view of the need for additional water, a simple conservative solution to the problem of analysis employs the techniques presented by Parmakian. Confirmation of the validity of the solutions is supported by field tests. (Bell Graf-Cornell)
W79-06939

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND JUNCTION AND DRY GULCH CREEKS, DURANGO, COLORADO.
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W79-06532

FLOOD HAZARD INFORMATION: COLORADO RIVER, PALISADE, COLORADO.
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W79-06533

THE EFFECT OF CERCOSPORA RODMANII, A BIOLOGICAL CONTROL FOR WATERHYACINTH ON THE FISH, GAMBUSIA AFFINIS,
Florida Univ., Gainesville. Dept. of Plant Pathology.
K. E. Conway, and R. E. Cullen.
Mycopathologia, Vol 66, No 1-2, p 113-116, 1978. 3 tab, 5 ref. OWRT A-033-FLA(7). 14-34-0001-8010.

Descriptors: *Biocontrol, Aquatic weeds, Plant pathogens, Pathogenic fungi, *Water hyacinth, Cercospora rodmanii.

The effect of Cercospora rodmanii, a fungal pathogen being developed as a biological control for waterhyacinth, was evaluated on Gambusia affinis in a standard 96-hour bioassay. Testing indicated that C. rodmanii had no adverse effects on treated fish and would not be a hazard to populations of these fish in nature. (Heaney-Florida)
W79-06558

RAIN WATER MANAGEMENT FOR LOWLAND RICE CULTIVATION IN INDIA,
Central Soil Salinity Research Inst., Karnal (India). Div. of Engineering.
V. V. D. Narayana.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineering, Vol. 105, No. IR1, Proceedings Paper 14430, p 87-98, March 1979. 12 fig, 7 tab, 9 ref, 1 append.

Descriptors: *Rainfall, *Storage, *Alkaline soils, Runoff, Hydrographs, Infiltration, Hydraulic conductivity, Ponds, Water resources, Crops, Rice, Precipitation(Atmospheric), On-site investigations, Water management(Applied), Agriculture, Hydrology, *India.

In India, only a small portion of the total rainfall is utilized for crop production; the rest runs off. Nearly 2,500,000 ha of alkali soils of the Indo-Gangetic region (characterized by flat topography and impermeable nature) remain unproductive due to surface water stagnation during the rainy season. The Central Soil Salinity Research Institute at Karnal, India, worked out design criteria and specifications for a three-tier system of rainwater management for these areas and hydrologically evaluated their performance. It was demonstrated that by adopting this rainwater management procedure, water use efficiencies were increased, drainage needs minimized, and groundwater recharge increased. (Sims-ISWS)
W79-06604

LEACHING CONTROL CAN'T BE PERFECT,
For primary bibliographic entry see Field 3F.
W79-06696

TO MARK SAMPLING EVENTS ON A RUNOFF HYDROGRAPH,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W79-06697

PENN STATE RUNOFF MODEL TO PINPOINT FLOOD-PRODUCING SUBAREAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
G. Aron, and D. F. Lakatos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 751, Price codes: A03 in paper copy, A01 in microfiche. Paper presented at ASCE Conference. Aug. 4-7, 1976, Purdue Univ., IN. 35 p, 11 ref 3 fig, 1 tab. Water Resources Journal. OWRT B-076-PA (3), 14-0001-5108.

Descriptors: Planning, Computer models, *Storm runoff, Surface runoff, Urbanization, Floods, Urban drainage, Urban hydrology, Urban runoff, *Model studies.

Successful urban water resources management depends on the ability of urban planners and managers to predict accurately, in advance, the effects that increased urban development will have on stormwater runoff. The present inability to predict watershed response is a major factor leading to increased urban flooding, and a lowering of runoff quality due to the lack of proper control. The situations for which the use of the Penn State Urban Runoff Model is intended are less general than those of many current urban runoff models. The Penn State Urban Runoff Model was developed as an alternative to the traditional Rational Method and other semi-empirical procedures for urban drainage design. It deals entirely with the quantity of stormwater runoff, and does not directly consider urban runoff quality. The objectives adopted for the development of the Penn State Urban Runoff Model were: (1) to produce an urban runoff simulation model which would provide acceptable hydraulic accuracy while remaining at a level of sophistication compatible with minimum practice and data collection time, (2) to

keep the model as simple and concise as possible to insure its convenient use, (3) to allow for the analysis of the timing of subarea flow contributions to peak rates at various points in a watershed. (Sink-Penn State)
W79-06730

SIZING TAILWATER RECOVERY SYSTEMS TO UTILIZE RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
Mao Liang-Tsi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 817, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis 1977, 88 p, 11 fig, 12 tab, 19 ref, 2 append. OWRT A-077-KAN (2).

Descriptors: Furrow irrigation, Storage volume, *Runoff, *Irrigated land, Precipitation, Tailwater.

Runoff from precipitation on furrow irrigated land is considered as an alternative source of irrigation water in Western Kansas. This helps to prolong the life of ground water supplies. A continuous watershed simulation model was used to estimate the amount of runoff generated from field-size furrow irrigated areas. The runoff was then routed through various sizes of tailwater recovery pits to determine the amounts of runoff utilized, based on continuous pumping systems. Pit size is the main factor affecting the percentage of runoff utilized. When the storage volume of the pit increases to 5 times the normal tailwater recovery pit size, about 70 percent of the runoff from precipitation was utilized. This is up to 10 percent of the total water used for irrigation. The quantity of ground water used decreases as the quantity of runoff utilized increases. Both of these terms can be expressed in a second-order polynomial equation. The sum of all the costs affected by the use of runoff from precipitation determines the optimum pit size. The factors which determine the optimum pit size are quantity of runoff availiable to be utilized, pumping lifts of well and pit, type of fuel used, and fuel price. If the fuel price and well pumping lift rise above a certain level, it might become economically feasible to construct a larger pit to utilize runoff from irrigated land.
W79-06733

HARVESTING RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas Water Resources Research Inst., Manhattan.
H. L. Manges, and Liang-Tsi Mao.
Paper No. 78-2559, Presented at 1978 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 18-20, 1978. 15 p, 2 fig, 3 tab, 10 ref, ASAE, St. Joseph, Michigan. OWRT A-077-KAN(3).

Descriptors: Tailwater, *Irrigated land, *Runoff, Precipitation, Water balance, Pumping.

Runoff from precipitation on irrigated land is an alternate source of water for irrigation. Use of such water can extend the life of ground water presently stored in underground aquifers. A tailwater management model was developed to simulate runoff from furrow irrigated land. Runoff volume from precipitation was estimated and routed to various sizes of tailwater pits. A daily water balance was maintained for both the soil and the pit. The tailwater management model was tested for corn growing on two commonly irrigated soil types on a quarter section of land near Garden City, Kansas. Twenty five years of continuous records of climatological data were used to simulate performance of the system. The tailwater pit was sized to hold multiples of one day's pumping for irrigation. Average annual precipitation was 473 millimeters and runoff from precipitation was 69 and 39 millimeters for Soil Types 3 and 5, respectively. Runoff from precipitation pumped back onto the field varied from 26 percent when the pit held runoff from one day's irrigation to 70 percent for a pit 5 times as large. Runoff from precipitation pumped from the tailwater pit was 3 and 7 percent of total water pumped for Soil Type 3, and 2 and 4 percent for Soil Type 5, respectively, with the smaller percentage pumped from the smaller pit.
W79-06734

A DRAINAGE MODEL FOR A RECLAIMED SURFACE MINE,
Iowa State Univ., Ames. Dept. of Agronomy.
L. Prunty, and D. Kirkham.
Soil Science Society of America Journal, Vol. 43, No. 1, p 28-34, January-February 1979. 9 fig, 1 tab, 15 ref.

Descriptors: *Mathematical models, *Mine drainage, *Strip mines, *Land reclamation, Crops, Steady flow, Water table, Terracing, Dupuit-Forchheimer theory, Soil profiles, Drains, Depth, Groundwater recharge, Hydraulic conductivity, Model studies, Row crops, Bench terraces.

Strip mine reclamation for row-crop production employing bench-terraced geometry is under study and may become increasingly common. A simplified model of the postreclamation soil profile at the Iowa Coal Project Demonstration Mine No. 1 was created. The model was used to find the steady-state water-table shape if one tube drain per terrace is installed. Dupuit-Forchheimer (D.F.) theory was used for the anayses. Water-table curves were generated for a series of alternative drain-tube locations. An analysis was made to find the best position for the drain tube. It was found that, for a recharge-to-soil-conductivity ratio of 0.01 for terraces repeating at a 45.7-m interval, the best drain-tube location is beneath the horizontal portion of the terrace 4.87 m from the toe of the backslope if the drain tubes are placed 2.44 m beneath the surface of soil underlaid by a barrier at 3.05 m depth. The horizontal portion of the bench terraces is 38.08 m, and the vertical drop from one terrace to the next is 3.05 m. A table of best drain locations was given for other drain depths and recharge rates. Previous work on D.F. theory for a uniformly sloped barrier was discussed briefly and compared with and contrasted to the present work for a barrier that parallels the bench-terraced surface of the reclaimed surface mine. (Visocky-ISWS)
W79-06743

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, MA. New England Div.
S. Cooper.
Type II Progress Report No 6, September 1, 1976. 13 p, 5 fig, 1 tab. NASA 22510.

Descriptors: *Remote sensing, *Satellites(Artificial), *Snow cover, *Watersheds(Basins), Instrumentation, Equipment, Water resources, Reservoirs, Reservoir operation, Snowpacks, Computers, Computer programs, Projects, *LANDSAT.

New England Division's LANDSAT downlink has been fully implemented, and the tracking system operates unattended with near 100% reliability. Software has been developed with the intention of the recovery from various malfunctions. Power interruptions do not abort the data collection function entirely, but if a satellite pass is in progress when a power failure occurs, the remainder of data from the current pass will be lost; however, the computer will recoup by the next pass. The LANDSAT tracking system integrates a set of about 20 programs or subroutines, about 10 disc data files, and several pieces of equipment. Essentially, the system predicts the satellite position, tracks the satellite, stores the incoming data, returns to the predicting program, and continues cycling in that fashion. Initial analysis of the 4 MSS energy band computer printouts showed that the greatest contrast between the areas of snow on open spaces, such as rivers and fields, and forested areas occurred on MSS band 5 (0.6-0.7 micrometers). (See also W77-02151) (Sims-ISWS)
W79-06762

RUNOFF EVALUATION OF CATCHMENTS AT GRANITE REEF,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
D. H. Fink, G. W. Frasier, and L. E. Myers.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson Arizona, Arizona Water Commission Report No. 10, p 26-32 (1977), 8 fig, 2 tab, 8 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Water yield improvement, *Surface sealing, Water conservation, Surface-runoff, Water spreading, Infiltration, Soil compaction, Soil sealants, Soil treatment, Costs, Vegetation effects, Membrane processes, Regression analysis, Asphalt, Plastics, Synthetic rubber, Arizona.

Described is a water harvesting research program conducted by the U. S. Water Conservation Laboratory, Phoenix, AZ, carried out at the Granite Reef test facility near Mesa, AZ. Laboratory and limited field studies commenced in 1959 with the intention of establishing and developing the most promising water harvesting materials and treatments. To evaluate treatments at Granite Reef, measurement of runoff efficienties for individual storms for extended periods of time was undertaken using linear regressional analysis. Results indicated that asphalt-fiberglass treatments yield nearly as much runoff per year as membrane sheetings like butyl rubber and polyethylene, and will outlast butyl under Arizona conditions, while being considerably less expensive to install. Paraffin wax treatments yielded nearly as well as butyl, showed no signs of weathering after 5 years and were even less expensive to install than asphalt-fiberglass. Other treatments that were evaluated were standard roofing, concrete, silicone and devegetation, smoothing and compaction, all of which were found to be less efficient in varying degrees at increasing runoff. (Tickes-Arizona)
W79-06832

COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA: A UNIQUE RIPARIAN ECOSYSTEM,
Mankato State Univ., MN. Dept. of Biology.
H. W. Quade.
In: Strategies for Protection and Management of Floodplain Wetlands and Other Riparian Ecosystems, GTR-WO-12. Proceedings of the Symposium, Callaway Gardens, Georgia, December 11-13, 1978, p 400-410. 5 fig, 5 tab, 10 ref. A-040-MINN(1).

Descriptors: *Drainage, *Drainage area, *Drainage effects, *Drainage practices, *Drainage programs, *Drainage systems, Minnesota, Lake Tetonka, Le Sueur County, Agricultural runoff, Farm wastes, Agricultural chemicals, Environmental effects, Land reclamation, Land management, Water quality, Water pollution sources, Legal aspects, Permits, Mapping.

Research is reported for the purpose of generating input data which will eventually allow a model of the drainage system in South Central Minnesota to be made. The extent and reasons for drainage in this area are addressed, and the findings of a case study on the effects of a drainage ditch on lake nutrient loading are reviewed. The constitutionality of drainage within Minnesota is also discussed. According to a 1959 agricultural census Minnesota had drained 11.7 acres of land representing 11.5% of all drained agricultural land in the U. S. An extensive mapping program of the drainage in this area, initiated because existing data was not dependable, becomes important, because significant differences in the extent of drainage data would result in differences in water resource planning by county, State or Federal planners. Water quality samples taken at several locations revealed that the major loading of Lake Tetonka in Le Sueur County comes from the Cannon River upstream of the confluence of the river and County Ditch 59. The water chemistry from a variety of ditches is being investigated. It is concluded that construction and maintenance of drainage ditches should follow the broadly based, environmentally assessed guidelines, and that it is possible for Minnesota to

ıave both quality agriculture and water resources. (Davison-IPA)
W79-06876

OPTIMAL WEEKLY RELEASES FROM A SEASONAL RESERVOIR 1. DETERMINISTIC FUTURE,
Electro-Watt Engineering Service Ltd., Zurich (Switzerland).
F. Laufer, and H. J. Morel-Seytoux.
Water Resources Research, Vol. 15, No. 2, p 383-398, April 1979. 15 fig, 4 tab, 22 ref.

Descriptors: *Reservoir releases, *Reservoir operation, *Optimization, *Hydrology, *Power economics, *Decision theory, *Operations research, Equations, Drawdown, Constraints, Runoff, Rivers, Water policy, Reservoir storage, Algorithms, Seasonal, Weekly, Electrical energy, Kuhn-Tucker conditions, Refill, Alpine watersheds, Lagrange multipliers, Finite capacity, Emptiness, Benefit maximization.

A technique is presented to maximize the returns rom the operation of a seasonal alpine reservoir or the production of electrical energy. The emphasis rests on a comprehensive approach to the problem, and the following fields are considered: ydrology, power economics, operations research, nd decision theory. The solution technique to etermine the optimal releases strategy is first developed for the deterministic case. It is based on he solution of the system of equations given by the Kuhn-Tucker conditions. As the direct solution of his system of equations is complicated, an alternative approach has been devised. The operation eriod is divided into two parts: the drawdown hase and the refill phase. For each phase, the ptimality conditions are solved by a procedure kin to Masse's constrained calculus of variations, he physical constraints being first ignored, and hen introduced in a stepwise manner. A preliminary study of the approximate nature of the optinal releases sequence provides a good starting oint in the variational procedure and the number f iterations necessary to arrive at the optimum is educed to a minimum. The application of the eveloped technique to a seasonal reservoir fed by n alpine watershed shows that the method is both easible and attractive. It is also well suited for eneralization to the case of an uncertain future, to e presented in a second paper. (Bell Graf-Cornell)
W79-06919

A COMPARISON OF THREE FLOODING REGIMES, ATCHAFALAYA BASIN, LOUISIANA,
Coastal Environments, Inc., Baton Rouge, LA.
. L. van Beek, K. Wicker, and B. Small.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 157, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/3-78-106, December 978. 90 p, 24 fig, 19 tab, 13 ref, 1 append. 68-01-299.

Descriptors: *Flood plains, *Regime, *Backwater, Regional development, *Planning, *Atchafalaya River Basin(Louisiana), Sediment discharge, Water evels, Rainfall, Fluctuations, Bayous, Flood control, River flow, Runoff, Watershed management, Bayou Fordoche, Buffalo Cove, Pat Bay.

A study of three backwater areas of the Atchafaaya Basin was undertaken to compare the hydrogic regime of sub-basins differing from each ther with respect to mode of flooding, stage variation, relative contribution of atchafalaya River vater and local runoff, and type of environment. Fordoche and Buffalo Cove located within the Atchafalaya Basin Floodway and subject to annual looding by the River, and Pat Bay located outside he floodway and in which flooding is controlled y local rainfall were selected for study. The comarison revealed the following as the most urgent eed for management of Atchafalaya Basin Floodvay units: (1) induction of low discharge flowthough to enhance water exchange in those areas urrently subject to a backwater regime and insufciently dewatered; (2) reduction of inflow associted with short term water level fluctuations during the annual rise of the River stages to reduce sediment introduction; (3) maximum utilization of the unit's surplus precipitation as a source of flood water to reduce inflow of Atchafalaya River water and sediments; and (4) the realization of these needs through water introduction at the upper end of the unit and simultaneous control over outflow at the lower end of the unit. (Davison-IPA)
W79-06943

4B. Groundwater Management

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 550, Price codes: A03 in paper copy, A01 in microfiche. Prepared for Washington State House of Representatives, Olympia, October 1976. 48 p.

Descriptors: *Water resources, *Water rights, *Irrigation, *Water requirements, *Irrigation effects, *Washington, Water use, Water costs, Social costs, Marketing, Economic feasibility, Hydroelectricity, Energy, Columbia Basin Project, Equity, Public benefits.

This report summarizes the findings of an in-depth study of irrigation in Washington State. The report considers: (1) the employment and population changes induced by irrigation development; (2) employment and income effects of irrigation development; (3) energy and irrigation in Washington; (4) social overhead capital costs of irrigation development; (5) marketing of irrigation products; (6) economic potentials for producing and processing high valued cash crops from new irrigated lands in Washington; (7) economic feasibility of irrigation development; and)(8) water use fee. The opportunities and result in net migration into the area. Land owners, some farmers, food processors and the transportation industry are among those who benefit from irrigation development. Even the general public will benefit from improved aesthetics, more recreational opportunities, and lower food costs. But there are costs involved when building large-scale irrigation projects in Washington. Large-scale diversions create large losses of hydroelectric generating capability whose costs are borne by power consumers and social overhead costs paid by the general public in the form of higher state and local taxes, higher rates for utilities, and higher costs for services such as waste disposal. The analysis of irrigation feasibility shows that little or no profit can be expected from irrigation development in the state at this time. The report concludes that the evidence points in favor of a water use fee, which would offset the cost of transferring water resources belonging to all to individuals for their private use. (Coan-NC)
W79-06544

U.N. GROUND WATER PROGRAM.
For primary bibliographic entry see Field 9B.
W79-06707

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-06738

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
For primary bibliographic entry see Field 2D.
W79-06748

THAT SINKING FEELING.
For primary bibliographic entry see Field 2F.
W79-06804

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
For primary bibliographic entry see Field 2E.
W79-06807

THE HEALTH EFFECTS OF GROUND WATER RECHARGE. PART I,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5C.
W79-06895

THE HEALTH EFFECTS OF GROUND WATER RECHARGE: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W79-06896

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5G.
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06906

GROUND-WATER COMPUTER MODELS - PRACTICAL TOOLS,
Wright Water Engineers, Inc., Denver, CO. Ground Water Div.
For primary bibliographic entry see Field 7C.
W79-06908

4C. Effects On Water Of Man's Non-Water Activities

THE WATER BUDGET AND POTENTIAL WATER RESERVES OF THE EAST AFRICA SOURCE REGION OF THE NILE,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
For primary bibliographic entry see Field 2A.
W79-06591

HYDROLOGIC IMPACTS OF SILVICULTURAL ACTIVITIES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
C. A. Troendle.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14437, p 57-70, March 1979. 9 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Forestry, *Forest management, *Forest watersheds, *Water pollution sources, Water pollution, Forests, Trees, Model studies, Mathematical models, Precipitation(Atmospheric), Runoff, Evapotranspiration, Streamflow, Watersheds(Basins), Mountains, Soil moisture, Hydrology

Most pollution associated with silvicultural activities has a nonpoint source and is difficult to control by conventional methods. Process-oriented techniques were developed to allow the planner, engineer, or hydrologist to evaluate the impact that any proposed silvicultural activity will have on the hydrology of the planning unit. Changes in the

hydrologic processes stimulate changes in non-point source pollution. As a part of the effort to quantify hydrologic impacts, the country was broken into 5 hydrologic regions. Hydrologic models were fitted to representative baseline watersheds in each region. Process stimulation was then used to develop response coefficients to be used to modify the regional baseline levels of evapotranspiration (ET), soil water, and streamflow as a function of cover, soil depth, aspect, latitude, and position in the watershed. This presentation summarized the results of the efforts and presented an evaluation of the usefulness of the methodology. (Sims-ISWS)
W79-06606

A PLANNING ALGORITHM TO ASSESS THE IMPACT OF URBAN GROWTH ON FLOOD EXPECTANCY,
Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
For primary bibliographic entry see Field 2E.
W79-06726

EXTERNALITIES FROM URBAN GROWTH: THE CASE OF INCREASED STORM RUNOFF AND FLOODING,
Iowa Univ., Iowa City. Inst. for Economic Research.
For primary bibliographic entry see Field 2E.
W79-06727

DISTRIBUTED ROUTING RAINFALL-RUNOFF MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.; National Weather Service, Silver Spring, MD. Hydrologic Sciences Div.; and Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06830

4D. Watershed Protection

EFFECT OF CHISEL VERSUS MOLDBOARD FLOWING ON SOIL EROSION BY WATER,
Science and Education Administration, Lafayette, IN. Soil, Water and Air Sciences.
C. B. Johnson, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol. 43, No. 1, p 177-179, January-February 1979. 3 tab, 3 ref.

Descriptors: *Soil erosion, *Erosion control, *Farm management, Erosion, Simulated rainfall, Runoff, Infiltration, Farms, Crops, Soils, Soil science, Agriculture, Plowing, Plowing practices, Moldboard plowing, Chisel plowing, Residues.

An experiment was conducted using simulated rainfall on a field that was chisel plowed annually for 13 years before the experiment to compare erosion from this condition with moldboard plowing in the same field. One treatment was fall moldboard plowed, a second fall chiselled with some residue left on the surface, and a third was untilled in the fall with all residue removed in the spring. All 3 treatments were disked lightly in the spring. After the initial experiment was completed, residue was added so that all treatments had about 20% surface cover. During the initial rain application with no residue added, soil losses from the third treatment without surface residue were the same as those from the chisel plowed and disked surface with some surface residue. Both these treatments had only 23% of the soil loss of the moldboard plowed and disked treatment. During succeeding simulated rainfall under wet and very wet soil conditions, soil loss from the disked only treatment was up to 80% of that for the moldboard-plowed treatment. When residue was added to all treatments, soil loss from the chisel-plowed treatment was less than one-half that from the moldboard-plowed treatment. (Sims-ISWS)
W79-06695

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NEW APPROACHES TO THE PRESERVATION OF CONTAMINANTS IN WATER SAMPLES,
Syracuse Research Corp., NY. Center for Chemical Hazard Assessment.
J. Saxena, and E. Nies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 013, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/4-79-007, 1979. 58 p, 11 fig, 6 tab, 61 ref.

Descriptors: *Preservation, *Sampling, *Nutrients, *Biochemical oxygen demand, *Oil, Microorganisms, Phosphorus, Nitrogen, Hydrogen ion concentration, Freshwater, *Stabilization.

The use of antibiotics, chemical biocides, and lytic enzymes to preserve nitrogen and phosphorus series of nutrients, biological oxygen demand, and oil and grease in water and wastewater samples, was investigated. Sample preservation was evaluated based on ability to inhibit cell growth and oxygen utilization in primary and secondary effluents and natural water samples. Drugs which exhibited potential were: chlorohexidine, vantocil IB, polymyxin B + neomycin + streptomycin (PNS), erythromycin + polymyxin B + neomycin (EPN), erythromycin + polymyxin B + streptomycin (EPS), polymyxin B + chloramphernical + neomycin (PCN) and gentamycin + amikacin + polymyxin B (GAP). For primary effluents, the effective concentration range was 100 - 200 micrograms/ml. Effective concentrations were 50 - 100 micrograms/ml for secondary effluents and 10 - 50 micrograms/ml for fresh waters. Chlorhexidine and vantocil IB stabilized nitrate and nitrite in fresh water and relatively clean secondary effluent. The antimicrobial agents did not offer a practical solution to the preservation of BOD in waste waters. Oil and grease levels were stabilized by GAP and PCN for up to two weeks in fresh water. Chlorhexidine and vantocil IB effectively stabilized pH and dissolved oxygen in natural water samples only. (Small-FIRL)
W79-06545

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W79-06590

FACTORS IN THE DETERMINATION OF SELECTED TRACE ELEMENTS IN NEAR-SHORE U.S. WATERS OF LAKES SUPERIOR AND HURON,
Environmental Research Lab., Duluth, MN.
J. E. Poldoski, E. N. Leonard, J. T. Fiandt, L. E. Anderson, and G. F. Olson.
Journal of Great Lakes Research, Vol 4, No 2, p 206-215, June 1978. 10 tab, 29 ref.

Descriptors: *Trace elements, *Lake Superior, *Lake Huron, *Great Lakes, Sampling, Chemicals, Chemical analysis, Chromium, Copper, Iron, Manganese, Nickel, Lead, Mercury, Lakes, Surveys, On-site investigations, Water pollution, Pollutants, Pollutant identification, Arsenic, Near-shore waters.

Determinations of total As, Cr, Cu, Fe, Mn, and Pb in acidified unfiltered water samples from 48 stations representing the nearshore waters of Lake Superior, Lake Huron, and selected incoming streams gave overall mean concentrations and standard deviations (microgram/L) of 1.0 + or - 0.7, 0.9 + or - 1.8, 2.0 + or - 1.8, 236 + or - 819, 14 + or - 34, and 0.7 + or - 0.8, respectively, using flameless atomic absorption analytical methods. Total concentrations of Ni and Hg were usually less than the instrumental detection limits (microgram/L) of 0.8 and 0.02, respectively. Small losses of Hg, As, and Cr from solutions are possible in addition to a molecular spectral interference in the determination of As using the graphite furnace method. River waters usually were only slightly higher in total element concentrations than lake waters, except for Fe and Mn. Nearshore waters of both lakes were very similar in elemental composition. (Sims-ISWS)
W79-06597

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT I DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
M. Sydor, K. R. Stortz, and W. R. Swain.
Journal of Great Lakes Research, Vol. 4, No. 2, p 142-148, June 1978. 7 fig, 2 tab, 14 ref. NASA NGL-24-005263, EPA R005286011.

Descriptors: *Remote sensing, *Great Lakes, *Pollutants, *Lake Superior, Satellites(Artificial), Turbidity, Suspended solids, Clays, Mine wastes, Erosion, Sediments, Particle size, Rivers, Lakes, Runoff, Pollutant identification, Water pollution, Water pollution sources, Limnology, LANDSAT.

Remote sensing signatures were developed for using LANDSAT data in identification of 4 types of particulate contaminants in Lake Superior. The criteria were based on the residual LANDSAT signal intensities and signal ratios. The signatures worked well in differentiation of river runoff from high background turbidity due to erosion and resuspension. The threshold concentrations for identification of suspended solids in lakes ranged on the order of 1 mg/L for clear lakes such as Lake Superior and 5 mg/L for light absorbing water characteristic of the Duluth-Superior Harbor. (Sims-ISWS)
W79-06600

STATISTICAL ANALYSIS OF THE 1975 INTERCOMPARISON STUDY ON LAKE ERIE,
Ohio State Univ., Columbus, Dept. of Statistics.
For primary bibliographic entry see Field 2H.
W79-06601

EFFECTS OF SEWAGE SLUDGE ON THE BENTHIC INVERTEBRATE COMMUNITY OF THE INSHORE NEW YORK BIGHT,
Brooklyn Coll., NY. Dept. of Biology.
M. L. Botton.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 169-180, February 1979. 2 fig, 6 tab, 24 ref.

Descriptors: *Sewage sludge, *New York, *Sludge disposal, *Marine animals, *Invertebrates, *Atlantic Ocean, Marine biology, Water pollution, Water quality, Surveys, Sampling, Sediments, Benthos, Benthic fauna, Biology, *New York Bight.

Benthic invertebrate community structure, including species diversity, biomass, and trophic structure, was examined at a sewage sludge disposal site and nearby 'control' site in the inner New York Bight off New York City. Although both sites are characterized by soft bottoms, have high organic carbon, and support similar deposit feeding assemblages, species diversity is lower at the sludge site, reflecting decreased species richness and evenness. Likewise, total biomass, as well as the proportional distribution of biomass among trophic groups, differed between sites. A previously suggested indicator species, Capitella capitata, is present in greater numbers at the control station than the sludge station. It is, therefore, unsuitable as an indicator species of pollution tolerance in the portion of the New York Bight examined in this study. A small polychaete belonging to the family Ampharetidae, Amage auricula, is by far the most abundant animal at the sludge disposal site, but its potential use as an indicator species is complicated by the fact that it exhibits a great tendency for aggregation. Ampeliscid amphipods appear sensitive to the presence of sludge and may be useful as indicators of contamination. Most of the common animals at both stations were aggregated, and it was recommended

hat future sampling in the area should be by the se of a larger number of small grabs such as the Shipek, rather than a smaller number of large grabs, as this will increase the probability that patchy fauna are encountered. (Sims-ISWS)
W79-06656

BIOTIC MONITORING,
Environmental Research Lab. Duluth, MN.
D. I. Mount.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 20-23.

Descriptors: *Bioassays, *Monitoring, *Pollution abatement, *Standards, *Industrial wastes, *Water Quality Control, Research and Development, Environmental effects, Water quality, Mortality, Toxicity, Water Quality Standards, Methodology, Sublethal effects, Prediction.

Past water pollution regulatory actions have dealt largely with eliminating existing unacceptable conditions from surface waters. Since the beginning of this decade, increased attention has been focused on preventing such conditions from developing. The shift has changed the informational need from one of assessing field conditions to one of predicting effects before they occur. A concomitant increased need for bioassays as predictive tools has occurred. Furthermore, analytical methods have not been developed to measure biologically active forms, and often they are not sensitive enough to measure concentrations at this 'no effect' level. In addition, the composition of wastes from today's industrial society are complex and variable and often contain many unidentified components. Therefore, aquatic bioassays are an essential tool for today's problems of aquatic environmental regulation. (Katz)
W79-06716

SOME MONITORING AND ANALYTICAL TECHNIQUES FOR THE STUDY OF LOCOMOTOR RESPONSES OF FISH TO ENVIRONMENTAL VARIABLES,
Texas A and M Univ., College Station. Dept. of Biology.
H. Kleerekoper.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p 110-120. 4 fig., 15 ref.

Descriptors: *Fish behavior, *Environmental effects, *Monitoring, *Water pollution effects, Analytical techniques, Equipment, Movement, Water temperature, Aquatic environment, Fish, Electronic equipment, Instrumentation, Methodology, *Sublethal effects, Responses, Locomotion, Avoidance.

The adaptive significance of locomotor, specifically orientation responses in fishes to environmental stimuli, is emphasized. General locomotor behavior is usually extremely variable over time whereas the responses mentioned are, most frequently, very subtle. Techniques are described to detect and quantify these responses by comparing locomotion before stimulation with that during exposure to the environmental variable(s) under study. Models for such comparisons are based on time series analysis of relevant locomotor variables, such as frequency and size of turns length and orientation of steps, velocity, and others. Two techniques for data acquisition of these variables, by means of monitoring locomotion thru electronics under controlled physical and chemical conditions, are described in some detail. Attention is called to the possible interaction of environmental conditions and the behavioral responses of fish, an aspect which, hitherto, has received too little consideration in studies on biological effects of environmental variables. (Katz).
W79-06717

SOME METHODS FOR HYPOTHESIS TESTING AND ANALYSIS WITH BIOLOGICAL MONITORING DATA,
Manitoba Univ., Winnipeg. Dept. of Zoology.
R. H. Green.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns Jr, K. L. Dickson and G. F. Westlake, Eds, American Society for Testing and Materials, 1977, p 200-211, 3 tab, 6 fig, 4 ref.

Descriptors: *Analytical techniques, *Distribution patterns, *Environmental effects, *Water pollution effects, *Mathematical studies, *Model studies, Spatial distribution, Temporal distribution, Monitoring, Benthos, Salts, Biological communities, Regression analysis, Methodology.

Procedures which are commonly used for determining the specific effect of an environmental change on a biological community are discussed and illustrated using a set of artificial data. Ninety-two stations on a kilometre grid are sampled for abundance of six benthic species and four environmental variables before and after an increased inflow of dissolved salts. A multiple regression model which assumes that species abundances are related to environmental variables in a linear additive manner yields inefficient and misleading results. Cluster analysis methods efficiently describe natural spatial patterns, but temporal changes are not detected. A linear additive model which relates changes in species abundances to changes in environmental variables removes the variation due to spatial pattern from the analysis and shows that biological changes related to increased salt concentrations have occurred. Methods for describing the changes and testing related hypotheses are presented. (Katz)
W79-06718

TIME AS A FACTOR IN BIOMONITORING ESTUARINE SYSTEMS WITH REFERENCE TO BENTHIC MACROPHYTES AND EPIBENTHIC FISHES AND INVERTEBRATES,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds, American Society for Testing and Materials, 1977, p 212-234, 3 tab, 9 fig, 52 ref.

Descriptors: *Monitoring, *Seasonal, *Diurnal, *Temporal distribution, Analytical techniques, Estuaries, *Water pollution effects, Biorhythms, Benthic fauna, Invertebrates, Statistical methods, Sampling, Fish, Water quality, Oxygen, Salinity, Fishkill, Biomonitoring, Diversity, *Apalachicola Bay(Florida).

Biological monitoring programs of estuarine communities is complicated by the highly unstable physical environment and variations in temporal relationships due to diurnal, tidal, seasonal and annual periodicities. Implications of temporal variation of the natural environment are discussed relative to the biological sampling necessary to account for the variability; examples are taken from studies in three bay systems along the Gulf Coast of north Florida. Causative elements of the impact of pollutants should be viewed in terms of diurnal and seasonal variations. Against this background the timing of pollutant entry into the system could control the nature of the impact. Community structure can be masked or distorted by inadequate sampling either on a short-term or seasonal basis. This, together with seasonally directed changes in the actual impact of a given pollutant, should be taken into consideration in the design of a biomonitoring program. (Katz)
W79-06719

A LASER-BASED OPTICAL FILTERING SYSTEM TO ANALYZE SAMPLES OF DIATOM COMMUNITIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
K. L. Dickson, J. P. Slocomb, J. Cairns, Jr., and S. P. Almeida.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p 121-132. 8 fig, 7 ref.

Descriptors: *Monitoring, *Diatoms, *Water quality control, *Biological communities, *Instrumentation, Phytoplankton, Optical properties, Water pollution effects, Water quality, Research and development, Design, Analytical techniques, Microorganisms, Optical filtering system.

This paper describes a biomonitoring system currently being developed that employs coherent optical spatial filtering techniques to rapidly identify diatoms and process species-abundance information. Preliminary results indicate that the optical problems associated with such a system can be overcome, although investigations are continuing into the problem of interfacing a microscope directly to the optical system. This system could eventually be employed in a management program along with chemical and physical data to obtain full beneficial use of the ecosystem without damage. (Katz)
W79-06720

EVALUATION OF AN AUTOMATED BIOLOGICAL MONITORING SYSTEM AT AN INDUSTRIAL SITE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
G. F. Westlake, and W. H. van der Schalie.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 30-37, 5 fig, 12 ref.

Descriptors: *Monitoring, *Bioindicators, *Technology, *Design, *Equipment, *Respiration, *Fish physiology, *Water quality control, *Industrial wastes, *Toxicity, Water quality, Pollutant identification, Pollution abatement, *Lepomis, *Biomonitor.

The feasibility of using biological monitoring of industrial point sources as a tool for river management has been demonstrated by a number of laboratory simulations. However, it is another task entirely to move these techniques to an industrial setting. The necessary modifications of a computerized biological monitoring system to install it in the Celanese Corporation Plant on the New River in Virginia are described. The system employs the respiration rates of bluegills (Lepomis macrochirus) as an indicator of abnormal variations in the effluent. (Katz)
W79-06721

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
K. Schiefer, and D. Lush.
Canadian Pulp and Paper Industry, Vol. 28, No. 5, p 34-35, 42-43, 46, May, 1975. 5 fig.

Descriptors: *Pulp and paper industry, *Waste water(Pollution), *Water pollution effects, *Environmental effects, *Surveys, Wastes, Industrial wastes, Water pollution sources, Toxicity, Biological properties, Water properties, Suspended solids, Dissolved solids, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Toxins, Aquatic life, Water pollution.

The principal objective of an environmental monitoring program is to define the effects of discharged wastes on various environmental parameters before significant or irreversible damage is done. Three main components of a comprehensive monitoring program for the pulp and paper industry (i.e., chemical, toxicological, and biological analyses) are discussed. Chemical studies quantify the parameters (e.g., suspended solids, total dissolved solids, dissolved oxygen, BOD, pH, and concentrations of specific toxicants) of the receiv-

ing stream, while toxicological studies determine the effects of a specific effluent on life forms. Biological studies (examination of the aquatic community present in the receiving waters) provide an accurate assessment of the quality of the environment and evidence of any effect on the community which may be due to a mill effluent. A hypothetical monitoring program indicating the type of sampling array and typical parameters being measured is illustrated. (Sykes-IPC)
W79-06722

DETERMINATION OF ACETONE AND METHYL ETHYL KETONE IN WATER,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. Y. Tai.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 151, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-123, October 1978. 36 p, 9 fig, 6 tab, 13 ref.

Descriptors: *Water analysis, *Organic compounds; *Analytical techniques, *Gas chromatography, Solvents, Water pollution, *Acetone, *Methyl ethyl ketone, Headspace analysis.

Analytical procedures for the determination of acetone and methyl ethyl ketone in water samples were developed. Concentrations in the milligram-per-liter range were determined by injecting an aqueous sample into the analysis system through an injection port, trapping the organics on Tenax-GC at room temperature, and thermally desorbing the organics into a gas chromatograph with a flame ionization detector for analysis. Concentrations in the microgram-per-liter range were determined by sweeping the headspace vapors over a water sample at 50C, trapping on Tenax-GC, and thermally desorbing the organics into the gas chromatograph. The precision for two operators of the milligram-per-liter concentration procedure, expressed as the coefficient of variation, was generally less than 2 percent for concentrations ranging from 16 to 160 milligrams per liter. The precision from two operators of the microgram-per-liter concentration procedure was between 2 and 4 percent for concentrations of 20 and 60 micrograms per liter. (Woodard-USGS)
W79-06812

AN APPROACH TO THE CLASSIFICATION OF UTAH MINE SPOILS AND TAILINGS BASED ON SURFACE HYDROLOGY AND EROSION,
Utah State Univ., Logan. Watershed Science Unit.
T. A. Burton, G. F. Gifford, and G. E. Hart.
Environmental Geology, Vol. 2, No. 5, p 269-278, 1978. 6 fig, 5 tab, 9 ref.

Descriptors: *Mine wastes, *Waste disposal, *Vegetation establishment, *Revegetation, *Mining, Coal mine wastes, Strip mine wastes, Mine water, Land subsistence, Spoil banks, Hydrology, Erosion, Overburden, Sediments, Land reclamation, Soil texture, Bulk density, Disposal, Compaction, Mulching, Statistical methods, Utah, Pollutants.

The present study classifies 35 mining deposits according to surface hydrologic and erosion characteristics within 24 Utah mining locations, 26 of which involves analysis of spoils or mined overburden wastes, 7 analysis of tailings, and 2 of ash deposits. Classification was achieved through cluster analysis to discover the inherent structure in the data and to evaluate similarities for the purpose of rating surface hydrologic limitations to revegetation. Results indicated that physical similarities among mine spoils may be strongly influenced by the geologic source of the spoils where overburden is produced from areas of simple geologic structure. Textures and bulk densities, on the other hand, are influenced by methods of handling during mining and disposal operations. Where these influences are the same in more than one site, surface hydrology and erosion parameters are often similar although a specific tailing deposit may be highly variable with respect to the physical and chemical characteristics produced by ore treatment and concentration. Suggestions for improved future rehabilitation with respect to the hydrologic characteristics of spoil deposits are: (1) conducting mining activities to permit identification and segretation of favorable overburden strata, (2) reconstituting soil for optimum plant growth, (3) shaping soils to be compatible with surrounding topography, (4) mulching with organic materials, and (5) avoiding compaction of the soil-spoil surface. (Tickes-Arizona)
W79-06844

SOURCE ASSESSMENT: TEXTILE PLANT WASTEWATER TOXICS STUDY -- PHASE I,
Monsanto Research Corp., Dayton, OH.
G. D. Rawlings.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 959, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-004h, March 1978. 169 p, 22 fig, 48 tab, 13 ref, 6 append. 68-02-1874.

Descriptors: *Water pollution sources, *Pollutant identification, *Industrial wastes, *Water pollution treatment, *Evaluation, *Toxicity, *Effluents, *Textiles, Sewage treatment, Sampling, Bioassay, Chemical analysis, Nutrients, Data collections.

Sampling, chemical analysis and bioassay procedures described are used to establish a baseline data base concerning toxicity and level of priority pollutants present in raw waste water and secondary effluents at 23 U.S. textile plants. Samples were analyzed for 129 consent decree priority pollutants, effluent guidelines criteria pollutants and nutrients; Level 1 chemical analyses were performed. Secondary effluent samples were submitted for the following bioassays: mutagenicity, cytotoxicity, clonal assay, freshwater ecology series, marine ecology series, 14-day rat acute toxicity, and soil microcosm. Bioassay results showed that 10 of the 23 plants have secondary effluents sufficiently toxic to proceed to a second phase of study wherein samples will be collected from the 10 plants to determine the level of toxicity removal attained by selected tertiary treatments. The plants are ranked according to relative secondary effluent toxicity. Modifications and recommendations for improvements to the sampling, chemical analysis, and bioassay protocols are discussed. (Davison-IPA)
W79-06867

QUANTITATIVE TECHNIQUES FOR THE ASSESSMENT OF LAKE QUALITY,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow.
Prepared for: Land Resource Programs Division, Inland Lake Management Unit and the Water Quality Division, Michigan Department of Natural Resources, Lansing, Michigan, September 1978. 138 p, 22 fig, 22 tab, 49 ref, 2 append.

Descriptors: *Lakes, *Management, *Water quality, *Assessment, *Eutrophication, *Phosphorus, *Quantitative methods, Model studies, Equations, Systems analysis, Sampling, Design, Data analysis, Lake classification.

The development of lake management policy calls for the determination of likely causal relationships among the lake and lake basin characteristics. This manual focuses on the role of phosphorus in lake eutrophication. Discussed is the importance of personal judgment of experienced managers in the design of a data gathering program and in the interpretation of the data and a model's prediction. On the whole, the manual outlines quantitative techniques that can be used to evaluate strategies for lake management. Chapter 2 presents a number of commonly employed statistical techniques for the design of sampling programs and for data analysis. Chapter 3 discusses the simple empirical models for phosphorus, and Chapter 4 outlines several schemes proposed for lake classification. Examples are presented to illustrate the use of the techniques described in those chapters. In conclusion, Chapter 5 briefly suggests additional research that may lead to refinements of the techniques presented herein. (Bell Graf-Cornell)
W79-06938

ACTINOMYCETES OF SEWAGE-TREATMENT PLANTS,
Rutgers - The State Univ., Piscataway, NJ. Waksman Inst. of Microbiology.
For primary bibliographic entry see Field 5D.
W79-06982

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 2. OIL AND GAS PRODUCTION INDUSTRY,
Radian Corp., Austin, TX.
G. E. Wilkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 639, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-023b, 1977. 130 p, 3 fig, 14 tab, 90 ref, 4 append.

Descriptors: *Oil industry, *Natural gas, *Effluent streams, *Waste water, *Pollutant identification, Water pollution sources, *Oily water, Brines, Sulfides, Air pollution, Industrial wastes.

The operations, processes, and effluent streams associated with the oil and gas production industry are characterized. Segments of the industry reviewed include: exploration and site preparation, drilling, crude processing, natural gas processing, and secondary and teritary recovery. Two process flow sheets and twenty process descriptions were developed to characterize operations. Input materials, operating parameters, utility requirements, and waste streams are reported for each process. The major waste streams resulting from oil and gas production contain hydrocarbons, oily brine, sulfides, sulfur compounds, and glycols. A large effluent stream is generated as a by-product of oil and gas production as an oily brine. Glycol-contaminated waste water is generated in natural gas processing. Offshore operations present a potential source of pollution when storms or shipping accidents cause uncontrollable well flows. Secondary recovery and drilling operations pose a potential contamination of aquifer zones by drilling fluids, brines, or hydrocarbons. Company and product information and related data are included. (Lisk-FRC)
W79-06984

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 7. ORGANIC DYES AND PIGMENTS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06985

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 10. PLASTICS AND RESINS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06986

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 26. TITANIUM INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06987

5B. Sources Of Pollution

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978, VOLUME I.
For primary bibliographic entry see Field 5C.
W79-06510

NVIRONMENTAL ASSESSMENT OF THE LASKAN CONTINENTAL SHELF. QUARERLY REPORTS OF PRINCIPAL INVESTIATORS JULY - SEPTEMBER 1978. VOLUME
ecember 1978. 678 p, NOAA, Environmental esearch Laboratories, Boulder, CO. Outer Contiental Shelf Environmental Assessment Program.

escriptors: *Baseline studies, *Alaska, *Hazards, Water pollution effects, *Resources development, Environmental effects, Data processing, Oil polition, Gases, Geology, *Outer Continental Shelf, etroleum development, Quarterly reports.

uarterly reports delineate objectives and progress baseline studies designed to assess the environental impact of resources development on Alas's Outer Continental Shelf. Emphasis is on hazds, transport, contaminant baselines and data anagement. (See also W79-06510) (Sinha-OEIS)
79-06511

NVIRONMENTAL ASSESSMENT OF THE LASKAN CONTINENTAL SHELF. QUARERLY REPORTS OF PRINCIPAL INVESTIATORS OCTOBER - DECEMBER 1978. OLUME II.
larch 1979. 54p, NOAA, Environmental Reearch Laboratories, Boulder, CO. Outer Contiental Shelf Environmental Assessment Program.

escriptors: *Baseline studies, *Alaska, *Reources development, *Environmental effects, Water pollution effects, Hazards, *Data, Transortation, *Outer Continental Shelf, Petroleum deelopment.

olume II contains numerous brief quarterly reorts of work in progress or planned which exames the effects of resources development on the uter Continental Shelf of Alaska. Various hazds and problems in the transport of petroleum esources, and efforts on data management are ncompassed. (See also W79-06512) (Sinha-OEIS)
79-06513

ASSAGE OF ANTICYCLONIC GULF TREAM EDDIES THROUGH DEEPWATER UMPSITE 106 DURING 1974 AND 1975,
ational Marine Fisheries Service, Narragansett, I. Atlantic Environmental Group.
J. Bisagni.
vailable from Supt. of Documents, GPO, Washgton, DC 20402, Price, $1.15. NOAA Dumpsite valuation Report 76-1, April 1976. 43 p, 28 fig, 3 b, 24 ref.

escriptors: *Eddies, *Spoil banks, *Meanders, Anticyclones, *Environmental effects, Water polition sources, Waste disposal, Path of pollutants, Outer Continental Shelf, *Ocean dumping, Gulf tream, New York Bight, Oceanographic data.

he formational theory and characteristics of antiyclonic Gulf Stream eddies in the western North tlantic Ocean are summarized. Their occurrence, ajectories, and structure, are observed using XBT ata and infrared satellite imagery to relate their assage through Deepwater Dumpsite 106 off the lew York Bight and over the continental slope nd rise. The frequency with which these eddies ass through the dumpsite, their residence times ithin the dumpsite, and the total time they ccupy the dumpsite each year are computed to etermine their potential effects on ocean dumpg. (Sinha-OEIS)
79-06514

UMMARY OF POTENTIAL HAZARDS AND NGINEERING CONSTRAINTS, PROPOSED CS LEASE SALE NO. 48, OFFSHORE OUTHERN CALIFORNIA,
1. R. Ploessel, S. C. Crissman, J. H. Rudat, R. on, and C. F. Lee.
n: Proceedings, Eleventh Annual Offshore Techology Conference, Houston, TX, April 30-May 3, 979. Volume 1, p 355-363, 13 fig, 6 ref, Oct No 398. Offshore Technology Conference, Dallas TX. 1979.

Descriptors: *Hazards, *Resources development, *California, Leases, Oil pollution, Water pollution sources, Geology, Exploration, Sites, Baseline studies, *Outer Continental Shelf, Petroleum development, Souther California, Geotechnical conditions.

Potential hazards and engineering constraints identified in proposed Outer Continental Shelf (OCS) Lease Sale Area No. 48, offshore southern California, include water deeper than 1000 ft, seafloor slopes of 4 to 70%, submarine canyons and channels, assorted mass movement phenomena, faults, possible accumulations of gas in the shallow sediments, and locally hard and irregular seafloor. These features and conditions were identified in a reconnaissance, multi-sensor high resolution seismic survey. Prior to developmental activities, detail site specific studies will be necessary to determine the potential influence of geologic features and conditions. Safe and environmentally acceptable exploration and development of possible petroleum resources appears feasible, provided the geologic and geotechnical conditions within the area are fully recognized and appropriate mitigating measures are taken to prevent potential problems. (Sinha-OEIS)
W79-06515

A SUMMARY OF INTERACTING, SURFICIAL GEOLOGIC PROCESSES AND POTENTIAL GEOLOGIC HAZARDS IN THE NORTON BASIN, NORTHERN BERING SEA,
D. R. Thor, and H. Nelson.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 377-385, 7 fig, 25 ref, OTC No 3400. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Geology, *Alaska, *Water pollution sources, Resources development, Leases, Oil pollution, Environmental effects, Baseline studies, Sediments, Erosion, *Outer Continental Shelf, Bering Sea, Norton Sound, Petroleum development.

A dynamic environment of moderate tectonism, sediment instability, and active erosional and depositional processes on the shallow sea floor of northern Bering Sea creates several potential geologic hazards. Active faulting, thermogenic gas seeps, sea-floor gas cratering, sediment liquefaction, ice gouging, scouring-depression formation, storm-sand deposition, and large-scale bedform movement all occur in the study area. Geologic processes may interact to cause such potential hazards as nearsurface faulting south of Nome, Alaska that provides pathways for seeps of thermogenic gas leaking from a large subsurface gas accumulation. Numerous faults also cut the sea floor in the area west of Port Clearance; fault activity is difficult to determine, however, because current scour may be preserving or exhuming old fault scarps. Interaction between the processes of liquefaction and the formation of gas craters, scour depressions, storm-sand deposits, and slumps results in potential sediment instability problems. The widespread occurrence of gas-charged sediment with small surficial craters in central Norton Sound indicates that the sea-floor sediment is periodically disrupted by sudden venting of biogenic gas from the underlying peaty mud. During major storms, liquefaction not only may help trigger crater formation, but also may enhance erosional and depositional processes that create large-scale scour areas and transport sand in the Yukon prodelta area. Interaction of erosional and depositional processes may result in hazards in the shallower parts of northern Bering Sea. (Sinha-OEIS)
W79-06516

NATURAL GAS SEEPAGE ON THE SOUTH TEXAS SHELF,
Texas A and M Univ., College Station.
J. M. Brooks, B. B. Bernard, W. M. Sackett, and J. R. Schwarz.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 471-478, 7 fig, 1 tab, 20 ref, OTC No 3411. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Seepage, *Water pollution sources, *Bacteria, *Texas, Baseline studies, Sediments, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Hydrocarbons, Petroleum development.

An area of extensive gas seepage has been found on the South Texas shelf. The seep area extends for a distance of approximately 25 miles on a transect out from the coast at latitude 26 degrees 10 minutes N. Water depths range between 65 and 130 meters. During nine samplings over a three year period, elevated near-bottom concentrations of methane (up to 500 nl/L), ethane (0.6 nl/LO, and propane (0.5 nl/L) compared to nearby surface and other near-bottom waters were observed. Anomalous gaseous hydrocarbon levels were also observed in the interstitial waters at three stations sampled in the region. Ethane and propane concentrations were typically one order of magnitude higher in these sediments compared to typical South Texas shelf sediments. The C sub 1/(C sub 2 + C sub 3) ratios in the sediments were as low as 14 indicating that the seepage may be of a petrogenic origin and not from shallow biogenic (microbial) sources. Significantly higher percentages of hydrocarbonoclastic bacteria were observed in the seep area. These may be a direct result of hydrocarbon seepage. No anomalous interstitial gas concentrations were observed in the 'Serendipity Gas Seep Area' of South Texas. (Sinha-OEIS)
W79-06517

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
K. A. Kvenvolden, C. H. Nelson, D. R. Thor, M. C. Larsen, and G. D. Redden.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 479-486, 3 fig, 2 tab, 21 ref, OTC No 3412. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Geology, *Water pollution sources, *Alaska, *Engineering geology, Sediments, Seepage, Natural gas, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Petroleum development, Biogenic gas, Thermogenic gas.

Chemical and isotopic compositions of sediment gas from Norton Sound have been determined for near-surface, gas-charged sediments at two sites identified in acoustic profiles and bottom observations. At one site air-driven vibracorer penetrated sediment saturated with methane. The isotopic value suggests that the methane originated from active biological processes operating on peat in the top 4 m of sediment. At the other site, characterized by a large subsurface acoustic anomaly, smaller near-surface acoustic anomalies and active seepage of gas, the vibracorer obtained sediment saturated with gas composed of 98% CO2. Associated with the CO2 are minor concentrations of petroleum-like light hydrocarbons. The carbon isotopic compositions of CO2 and methane along with the chemical distribution of gaseous hydrocarbons indicate that at this site these gases are derived from thermal processes operating at depth in Norton Basin. Apparently CO2 from the decarbonation of marine limestone acts as a carrier for hydrocarbon gases that have been generated from organic matter buried in the basin. The gases reach the surface by faults and escape at the seafloor as a submarine seep. The presence of near-surface gas-charged sediment in Norton Sound reduces the stability of the seafloor. Areas where sediments are charged with gas may pose potential hazards for engineering developments. (Sinha-OEIS)
W79-06518

AT-SEA DISCHARGE OF OCEAN MINING PROCESS REJECTS - AN ALTERNATIVE TO LAND DISPOSAL,

C. L. Morgan, and F. T. Lovorn.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 2, p 807-813, 1979. 2 fig, 19 ref, OTC No. 3451. Offshore Technology Conference, Dallas, TX.

Descriptors: *Waste disposal, *Mining, *Water pollution sources, *Baseline studies, Resources development, Water pollution effects, Environmental effects, *Outer Continental Shelf, North Pacific Ocean, At-sea discharge.

The Ocean Minerals Company has carefully evaluated potential impacts of ocean discharge even when most of the evidence suggests that significant impacts do not occur. This 'worst case' approach is similar to that which has been adopted by most principal investigators in the DOMES program. During the last several years an 'in house' project has focused upon a number of topics which compliment those covered by the government programs or which are peculiar to the OMCO system. These include: (1) baseline measurement of metal values in the oceans; (2) determination of the settling rates and solid/liquid composition of various mixtures of seawater and reject materials; (3) comparison of the effects of land-based discharge with the effects of at-sea discharge; and (4) design of a long term environmental monitoring system. To date, these studies indicate that at-sea discharge may cause an insignificant amount of environmental damage and is in many ways preferable to land discharge. (Sinha-OEIS)
W79-06519

A COLLISION AVOIDANCE SYSTEM FOR OFFSHORE OPERATIONS,
R. F. Riggs.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 2, p 1291-1299, 1979. 9 fig, 2 tab, 15 ref, OTC No. 3504. Offshore Technology Conference, Dallas, TX.

Descriptors: *Hazards, *Navigation, *Oil pollution, Oil spills, Water pollution sources, Resources development, *Outer Continental Shelf, Collision avoidance, Oil transport, Predicted-area-of-danger(PAD).

The surge of offshore resource development has resulted in a high density of both fixed and mobile hazards to navigation in some areas. The situation is aggravated when coastal shipping encounters these hazardous areas. Collisions between tankers, rigs, drilling platforms, etc., may result in serious danger to personnel, equipment losses and oil spills. In certain weather conditions, lights and acoustic signaling devices may be ineffective as collision avoidance aids and reversion to radar as the primary sensor may be inevitable. Greatly reduced probability of collision can be achieved through the use of an automated collision avoidance aid that permits rapid assessment of the situation and the determination of a safe, efficient maneuver. Types of operational collision avoidance systems are reviewed and compared. The mix of moving and fixed hazards is one problem that the system must handle. Tidal currents and winds can complicate the maneuvering solution. It is shown that the use of the predicted-area-of-danger (PAD) as a collision avoidance concept overcomes the problems peculiar to maneuvering in offshore gas and oil fields. Experience with the highly successful use of the PAD concept in the dense traffic of the English Channel is reviewed. (Sinha-OEIS)
W79-06520

AN INTRODUCTION TO THE OILSPILL RISK ANALYSIS MODEL,
K. J. Lanfear, R. A. Smith, and J. R. Slack.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2173-2181, 11 fig, 4 tab, 7 ref, OTC No 3607. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil spill, *Hazards, *Models, *Risks, Water pollution effects, Path of pollutants, Environmental effects, Resources development, *Outer Continental Shelf, Petroleum development, Risk analysis.

The U.S. Geological Survey has developed an oilspill risk analysis model to aid in estimating the environmental hazards of developing oil resources in Outer Continental Shelf (OCS) lease areas. This large, detailed, computerized model analyzes the probability of spill occurrence, likely paths of the spills, and locations of recreational and biological resources which may be vulnerable. The analysis implicitly includes estimates of weathering rates, slick dispersion, and possible mitigating effects of cleanup. The probability of spill occurrence is estimated from information pertaining to the volume of oil expected to be produced and the anticipated method and distance of transport. The model provides the Department of the Interior with a method for realistically assessing oilspill risks associated with OCS development. So far, it has been used for analyzing oilspill risks for eight OCS lease sales, and the results have been incorporated into several environmental impact statements. A 'real-time' version was also used to forecast the movement of the Argo Merchant oilspill. Additional model runs are planned for future OCS lease sales in frontier areas. Other possible applications include analysis of OCS development alternatives and site selection for oilspill cleanup equipment. (Sinha-OEIS)
W79-06523

SHIPBOARD OILY WATER POLLUTION - A PRACTICAL GUIDE FOR THE OWNER AND DESIGNER,
A. D. Isaacson.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2183-2192, 5 fig, 12 ref, OCT No 3608. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil pollution, *Pollution abatement, *Water pollution control, Resources development, Oily water, Ships, Regulation, Transportation, *Outer Continental Shelf, Petroleum development, Oily water separators.

This paper is presented as an aid in understanding the U.S. and International (IMCO) regulations with regard to shipboard oil pollution and as a guide for selecting and installing an oily water separating device as it pertains to a particular situation. The information presented is based upon recent projects in which various type vessels have been upgraded to comply with oil pollution regulations. The latest information regarding IMCO and US Coast Guard regulations as applicable to new and existing vessels are presented as well as means for complying. Covered are the various areas of possible shipboard oily water contamination such as machinery bilges, tank cleaning and oil transfer operations. Commercially available oily water separators are discussed and presented to assist the reader to judge the applicability for his particular case. (Sinha-OEIS)
W79-06524

WESTERN GULF OF ALASKA SEISMIC RISK,
Alaska Univ., Fairbanks. Geophysical Inst.
H. Pulpan, and F. Kienle.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2209-2218, 12 fig, 19 ref, OTC No 3612. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Seismic studies, *Hazards, *Alaska, *Risks, Model studies, Baseline studies, Water pollution sources, Resources development, *Outer Continental Shelf, Petroleum development.

Seismicity studies, based on both historic data and data accumulated from the operation of a high resolution seismic network, provide some important input into quantitative seismic risk studies for areas of offshore petroleum development in Lower Cook Inlet, Shelikof Strait and off Kodiak Island. The greatest seismic risk is associated with the shallow seismic thrust zone of the subducting Pacific plate. There is a high probability that a great earthquake will occur in the Shumagin gap within the lifetime of any potential petroleum development in that area. The relative sharpness of the transarc boundaries of the aftershock zones of great earthquakes in the Aleutians suggests that a shallow thrust zone is segmented into separate tectonic blocks within release accumulated strain independently. There is geologic and seismic evidence that one such boundary traverses the arc near the southern edge of Kodiak and separates the 1964 aftershock zone from the Shumagin gap. Additional segmentation may exist within the 1964 aftershock zone. Seismic risk appears lower in the other offshore areas that do not overlie the shallow subduction thrust zone, but is still primarily associated with the subduction process. The shallow, crustal seismic activity (less than 50 km hypocentral depth) outside the subduction thrust zone does not correlate with the major known fault systems of the area, and is of a more diffuse nature. (Sinha-OEIS)
W79-06527

A SEA-FLOOR SEISMIC MONITORING NETWORK AROUND AN OFFSHORE OILFIELD PLATFORM AND RECORDING OF THE AUGUST 13, 1978 SANTA BARBARA EARTHQUAKE,
University of Southern California, Los Angeles.
T. L. Henyey, T-I. Teng, J. K. McRaney, and D. V. Manov.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2219-2223, 6 fig, 16 ref, OTC No 3613. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Seismic studies, *Risks, *Monitoring, *California, Offshore platforms, Water pollution sources, Resources development, Oil fields, Earthquakes, *Outer Continental Shelf, Petroleum development, Santa Barbara(CA) earthquake.

An eight element seismic monitoring array has been established around the Dos Cuadras offshore oil field in the Santa Barbara Channel, a highly faulted region with a history of important seismicity. The array consists of five sea floor seismometers and three onshore coastal zone stations. The proper mechanical coupling of ocean-bottom seismometers to the sea floor has been a problem. The existence of a layer of soft sediments on top of the sea floor often results in severe attenuation of the transmitted seismic waves. A method has been devised of installation whereby the sea floor sensors are inserted into pipes vibracord 2-5 meters into the sea floor where water depths range from 20 to 100 meters. The sensor outputs are transmitted by sea floor coaxial cables to a central platform and then telemetered (in combination with the onshore stations) via telephone line to a recording facility in Los Angeles. Records from the August 13, 1978 Santa Barbara earthquake and its aftershocks demonstrate that the method of sensor emplacement used gives superior coupling to the sea floor resulting in a record with low distortion and good signal to noise characteristics. The minimum detection threshold for events within the Dos Cuadras field should be on the order of M = 1.5 with epicentral locations determined to better than 1 km. The added complexities of offshore oil fields enhance the desirability of a comprehensive seismic monitoring effort. (Sinha-OEIS)
W79-06528

ENVIRONMENTAL HAZARDS: CONSIDERATIONS FOR OUTER CONTINENTAL SHELF DEVELOPMENT,
P. G. Teleki, L. E. Garrison, and M. A. Hampton.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2579-2589, 66 ref, Oct No 3654. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Resources development, *Risks, *Baseline studies, Environmental effects,

Water pollution sources, United States, Oil pollution, Offshore platforms, *Outer Continental Shelf, *Potential hazards, Petroleum development.

Expansion of offshore petroleum operations into unknown frontier areas, deeper waters, and more hostile environments has increased industry's and the Government's awareness about environmental hazards on the Outer Continental Shelf (OCS). Data on environmental exposure are absent in the public domain although these data (1) are needed to test engineering concepts for the design of offshore structures, (2) are factors in leasing on the OCS, and (3) govern economic decisions on petroleum exploration and production. The summary of environmental hazards on the U.S. Continental Shelf presented shows much variability in the hazard potential among OCS areas and complex interactions among various types of hazards within a single area. The U.S. Geologic Survey is actively studying the stability and properties of marine sediments, extreme wave conditions, earthquake-induced ground motion, and arctic sea ice and permafrost to improve its understanding of the processes governing the existence and behavior of these hazards. (Sinha-OEIS)
W79-06529

AUTOMATED SAMPLING ANALYSIS OF RURAL NONPOINT SOURCE WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Bliven, F. J. Humenik, F. A. Koehler, and M. R. Overcash.
Paper No. 78-2509, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 10 p. 5 fig, 4 tab, 18 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water quality, Water pollution, Water sampling, Water pollution sources, *Automation, Water yield, Ion transport, Base flow, Flow duration, *Nonpoint pollution.

Automated sampling was employed to assess constituent (COD, TOC, TP, TKN, NO3-N, and Cl) yields and concentrations from two Piedmont sites in Virginia and two poorly-drained Coastal Plain sites in North Carolina within the Chowan River watershed. These data were analyzed to provide a mechanistic interpretation of subbasin processes. Characteristic Piedmont and Coastal Plain seasonal water yield cycles which have winter maximums and summer minimums were related to regional potential water yields (rainfall minus evapotranspiration). Large water yield variations for subbasins within each region, however, were attributed to physical differences between subbasins. Greater water yield from the agricultural Piedmont site than from the forested Piedmont site reflected increased cleared land plus greater channelization both on the basis of channel density and channel gradient at the agricultural site. Elevated baseflow, probably due to stream channelization, was the dominant factor contributing to water yield due to stream channelization, was the dominant factor contributing to water yield differences between two Coastal Plain subbasins. Surface flow COD, TOC, TP, TKN and NO3-N concentrations were usually greater than baseflow concentrations, but at the unchannelized Coastal Plain site the opposite case prevailed and at all sites surface flow Cl concentrations were less than baseflow concentrations. The seasonal concentration cycle displayed a summer maximum and winter minimum and thus it was out of phase with the water yield cycle. (Skogerboe-Colorado State)
W79-06548

KEPONE/MIREX/ HEXACHLOROCYCLOPENTADIENE: AN ENVIRONMENTAL ASSESSMENT.
National Research Council, Washington, DC.
For primary bibliographic entry see Field 5C.
W79-06566

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER.
SCS Engineers, Long Beach, CA.
For primary bibliographic entry see Field 5C.
W79-06567

BOOMS USED FOR OIL SLICK CONTROL,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5G.
W79-06589

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
A. A. Qureshi, and B. J. Dutka.
Water and Sewage Works, Vol 126, No 3, p 86-88, March 1979. 1 fig, 2 tab, 7 ref.

Descriptors: *Water pollution sources, *Canada, *Urban runoff, *Storm drains, *On-site investigations, Storm runoff, Surface runoff, Water sampling, Water pollution, Pollutants, Coliforms, Fungi, Pathogenic bacteria, Analysis, Methodology, Testing procedures.

A storm sewer outfall on Malvern Road in Burlington, Ontario, (population 104,000) was selected as a study site. This outfall empties directly into small creek and drains a 23.3 ha section of central Burlington. The entire area is zoned as single-family, residential, and there are no vacant lots within the area. The majority of the houses have eaves-troughs connected directly to storm sewers that are 100% separated. Routine microbiological samples for coliforms, fecal coliforms, fecal streptococci, Pseudomonas aeruginosa, fungi, heterotrophs, salmonella/100 ml, and Leptospira/100 ml were hand-collected at the weir outfall. The first samples were collected after the rain started, as soon as there was a noticeable change in the flow rate. Traditional indicator densities such as coliforms, fecal coliforms, and fecal streptococci approached dilute sewage concentrations during each event, thus reemphasizing the health hazards due to pathogenic bacteria and viruses that are contained within these storm-runoff waters. Indications were that it is not possible to predict peak time for microbial populations to occur in runoff waters or the appearance of human pathogens. (Humphreys-ISWS)
W79-06590

ON THE CONCENTRATION OF SULFATE IN PRECIPITATION,
Battelle Pacific Northwest Labs., Richland, WA.
B. C. Scott, and N. S. Laulainen.
Journal of Applied Meteorology, Vol 18, No 2, p 138-147, February 1979. 6 fig, 4 tab, 26 ref. ERDA EY-76-C-06-1830.

Descriptors: *Sulfates, *Precipitation(Atmospheric), *Nucleation, Air pollution, Clouds, Cloud physics, On-site investigations, Radar, Sampling, Chemical analysis, Drops(Fluid), Snow, Aerosols, Chemicals, Sulfur compounds, Meteorology.

Two case studies were used to examine the relationship of the sulfate concentration in surface precipitation to the microphysical characteristics of the precipitating cloud systems. The data from one case study supported the contention that existing sulfate aerosol was incorporated into cloud water by the nucleation process and accounted for nearly all of the observed cloud and precipitation water sulfate concentration. These activated sulfate particles comprised nearly 60% of the clear-air sulfate mass concentration. Once nucleated, the sulfate particles accumulated water through the condensation process and were subsequently deposited at the surface after accretion on large snowflakes. The presumption of aqueous phase sulfate oxidation of SO2 was not necessary to account for the observed sulfate concentrations. The data from the second case study were more limited and difficult to interpret. Nucleation and below cloud washout appeared to be the main contributors to the surface concentration in precipitation water. (Sims-ISWS)
W79-06592

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W79-06599

HYDROLOGIC IMPACTS OF SILVICULTURAL ACTIVITIES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
For primary bibliographic entry see Field 4C.
W79-06606

TRANSPORT OF REACTING ADMIXTURES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
B. A. Fidman.
Water Resources, Vol 4, No 6, p 918-925, November-December 1977. 10 ref. Translated from Vodnye Resursy, No 6, p 148-155, November-December 1977.

Descriptors: *Turbulent flow, *Mixing, *Suspended solids, *Pollutants, Water pollution, Diffusion, Dispersion, Model studies, Mathematical models, Equations, Sediment transport, Streams, Streamflow, Hydraulics, Hydrology.

The transport by turbulent flows of admixtures which can react with solutions or fine particles contained in the water is of interest, particularly when analyzing processes of pollution and self-purification of streams and water bodies. This article touched on (as a brief review with explanations and comments) certain characteristics of the joint action of turbulent diffusion and kinetics of the reactions. An estimation of the parameters of transport and mixing of reacting admixtures in a turbulent flow as a consequence of a number of simplifying assumptions can give only rather rough, approximate results. Refinement and broadening of the results obtained as applied to more complex conditions requires the further development of investigations of turbulent transport and, in turn, such characteristics of it as longitudinal dispersion and the transverse (horizontal) turbulent diffusion determining it in natural and regulated streams. Further actual measurements on large streams, permitting an empirical determination of the values of longitudinal dispersion, are also needed. (Sims-ISWS)
W79-06613

FACTORS GOVERNING THE BIOLOGICAL PRODUCTIVITY, REGIME, AND CONTENT OF BIOGENIC AND ORGANIC SUBSTANCES IN THE SEQUENCE OF DNEPR RESERVOIRS,
Akademiya Nauk URSR, Kiev. Inst. Hydrobiologii.
A. I. Denisova.
Water Resources, Vol. 4, No. 6, p 885-895, November-December 1977. 4 tab, 13 ref. Translated from Vodnye Resursy, No. 6, p 106-119, November-December 1977.

Descriptors: *Organic matter, *Biological properties, *Water quality, *Reservoirs, Nutrients, Nitrogen compounds, Phosphorus, Vegetation, Trees, Phytoplankton, Runoff, Rivers, Water pollution, Water pollution sources, *Dnepr River(USSR), Biogenic matter.

Organic and biogenic substances, being the basis of biological productivity of water bodies, in the majority of cases determine also the quality of water used for various economic purposes. Systematic investigations carried out on reservoirs of the Dnepr River over the course of two decades (1955-1975) revealed the main factors and processes governing the content, dynamics, and transformation of bioelements in reservoirs and their bio-

logical productivity. The content of biogenic and organic substances in water of reservoirs depends on two diametrically opposite processes: on one hand, on their entry with different sources and, on the other, on their removal from the aquatic environment in the form of the end products of mineralization of substances of plant and animal origin, sedimentation, consumption by aquatic organisms, binding by heavy metals into stable complexes, etc. The sources enriching the water of Dneper reservoirs in biogenic elements and organic substances of both natural and antropogenic origin include: the runoff of the main river feeding the sequence of reservoirs, surface runoff and interflow from the drainage basin, flooded bed (in the first years), industrial and domestic wastewaters, runoff from farmlands, precipitation, erosion of the shores, bottom deposits, in situ processes, etc. Their quantitative evaluation, made on the basis of experimental and actual investigations or by calculations, was presented. (Sims-ISWS)
W79-06614

ACCURACY EVALUATION IN THE CALCULATION OF MASS-DISCHARGES,
National Inst. of Scientific Research (Quebec).
H. Weber, D. Cluis, and B. Bobee.
Journal of Hydrology, Vol. 40, No. 1/2, p 175-184, January 1979. 3 fig, 9 ref.

Descriptors: *Water quality, *Dissolved solids, *Discharge(Water), *Hysteresis, Sampling, Variability, Statistical methods, Simulation analysis, Flow, Estimating, Analysis, Equations, *Mass discharge, *Concentration, *Nonpoint sources, *Saint-Francis River.

Water quality sampling programs are designed mostly upon known or assumed variabilities of the concentrations. As one goes further into the interpretation of this information, mass-discharge calculation is often required afterwards for the evaluation of transport phenomena. The accuracy of mass-discharges is generally related to the errors in the flow and concentration measurements, but the inaccuracy resulting from the computational procedure itself is often overlooked, leading to gross misinterpretations. In the common case of a basin with composite land-uses, no clear-cut relationship between concentrations and discharges can be expected. With discharges available on a daily basis and water quality samplings occurring at periodic intervals, several approximation formulas for mass-discharge computation are available. A formulation was retained taking advantage of the whole information content of the measurements, and a simulation technique was applied to estimate its accuracy. The results were then presented in terms of accuracy estimations in relation to the frequencies of sampling and to the intrinsic variabilities and relative cyclicities of concentrations and discharges. (Singh-ISWS)
W79-06619

METHOD FOR LAKE RESTORATION,
Battelle Memorial Inst., Richland, WA. (Assignee).
For primary bibliographic entry see Field 5G.
W79-06640

FLUCTUATIONS OF CHLOROPHYLL AND RELATED PHYSICAL PARAMETERS IN BRITISH COLUMBIA COASTAL WATERS,
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06644

SPECTRAL AND BIOCHEMICAL CHARACTERISTICS OF THE PARTICULATE MATTER IN BEDFORD BASIN,
Biochimie Marine, Villefranche-sur-Mer (France). Station Zoologique.
For primary bibliographic entry see Field 2L.
W79-06645

SUMMER PLANKTON DISTRIBUTIONS ASSOCIATED WITH THE PHYSICAL AND NUTRIENT PROPERTIES OF THE NORTHWESTERN GULF OF ST. LAWRENCE,
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06646

DISTRIBUTION OF NUTRIENTS IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 2L.
W79-06650

LINE PLUME AND OCEAN OUTFALL DISPERSION,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
P. J. W. Roberts.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14488, p 313-331, April 1979. 12 fig, 12 ref, 2 append.

Descriptors: *Outfall sewers, *Dispersion, *Diffusion, *Waste dilution, Mixing, Flow, Currents(Water), Buoyancy, Model studies, Mathematical models, Laboratory tests, Froude number, Equations, Oceans, Waste disposal, Plumes, Dilution, Diffusers.

The three-dimensional flowfield created by a line plume of finite length in a steady unstratified current was investigated experimentally and theoretically. The results are applicable to ocean sewer outfall design. Even though the diffuser length may be much greater than the water depth, the flowfield cannot be considered to be two-dimensional. The most important dynamic parameter is a Froude number, F, given by the ratio of the current speed cubed to the buoyancy flux discharged per unit diffuser length. Different mixing regimes can occur depending on the value of F, and the plume can be attached to the lower boundary. Dilution depends on current speed and direction only for F greater than 0.1. For F greater than 0.1, dilution increases with current speed, and diffusers perpendicular to the current will result in greater dilution than if parallel. The surface wastefield spreads rapidly in a parallel current, showing that Y or similarly shaped diffusers are not essential to produce a widely dispersed wastefield. The buoyant spreading of the surface wastefield is a complex phenomenon, having growth laws that change with distance downstream. (Sims-ISWS)
W79-06651

VENICE: SEA-LAGOON EXCHANGE IN A MODIFIED TIDE RANGE,
Consiglio Nazionale delle Richerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grandi Masse.
For primary bibliographic entry see Field 2L.
W79-06659

EVALUATION OF CONCEPTUAL MODELS FOR DESCRIBING NONEQUILIBRIUM ADSORPTION-DESORPTION OF PESTICIDES DURING STEADY-FLOW IN SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W79-06662

FINAL REPORT ON THE BASELINE ENVIRONMENTAL SURVEY OF THE MAFLA LEASE AREAS.
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.
Final Report, April 1978. J. E. Alexander, (Ed.). 200 p, 11 fig, 37 tab. 08550-CT4-11.

Descriptors: *Baseline studies, *Water pollution sources, *Water pollution effects, *Gulf of Mexico, Environment, Resources development, Exploration, Oil, Gases, Chemistry, Biota, Geology, *Outer Continental Shelf, Petroleum development, Mississippi-Alabama-Florida(MAFLA).

In this baseline study, the State University System of Florida, Institute of Oceanography (SUSIO) Consortium's survey was directed and largely restricted to five discrete lease areas on the Mississippi-Alabama-Florida (MAFLA) shelf of the eastern Gulf of Mexico, extending from approximately 89 degrees W, south of Pascagoula, Mississippi, to a tract west of Clearwater, off Tampa Bay, Florida. Existing pollutants in the offshore submerged land area are an important consideration, for in order to make meaningful use of baseline surveys on the shelves one must quantify contaminant levels, as well as be able to determine their origin. The chief objective of this study, as mandated by the Bureau of Land Management, was to sample water, sediments and organisms on the leased tracts before arrival of drilling rigs in mid-summer of 1974. (Sinha-OEIS)
W79-06668

THE RELATIONSHIP BETWEEN BEST MANAGEMENT PRACTICES AND RECEIVING-WATER STANDARDS,
URS Co., Seattle, WA.
G. R. Minton, D. Anderson, and A. Coburn.
Water Resources Bulletin, Vol. 14, No. 6, p 1440-1448, December 1978. 28 ref.

Descriptors: *Nonpoint pollution, *Standards, *Water pollution control, *Management, *Receiving water, *Regulation, Best management practices, Programs, Legislation.

An important enforcement question is, 'What should be the relationship between 'Best Management Practices' (BMP) and receiving-water standards.' Nonpoint pollution discharges are concerned about implementing a BMP program, only to find themselves in violation because receiving-water standards still have not been met. They are also concernd about the procedures a regulatory agency will utilize to determine the relative success of a BMP program. Successful management of nonpoint pollution requires that these concerns be addressed. Three alternative relationships have been developed. The recommended alternative is to implement the BMP program and use standards as a measure of the effectiveness of the program. Failure to achieve the standards would lead to a reevaluation of the BMP program. Enforcement activities against nonpoint dischargers would be restricted to the failure on their part to implement the previously agreed upon BMP program. Recommendations are also made as to measures regulatory agencies should take if their procedures to judge the relative success of a BMP program are to be technically and politically effective. (Bell Graf-Cornell)
W79-06669

SURFICIAL SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
G. L. Freeland, and D. J. P. Swift.
MESA New York Bight Atlas Monograph 10. New York Sea Grant Institute Report No NYSSG-AM-78-004, December 1978. 93 p, 11 fig, 2 tab, 116 ref, 64 maps, 2 append.

Descriptors: *Sediments, *Bottom sediments, *Water pollution sources, *Waste disposal, *Water pollution effects, Spoil banks, Outfall sewers, Sewage sludge, Continental Shelf Environmental effects, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Dredge spoil.

The surficial sediment cover of the continental shelf in New York Bight consists of a sheet of sand up to 10 m thick with small areas of gravel and muddy sand. Off the shelf edge, mud increases to become the dominant sediment. Most sediment was first deposited during or soon after the last glacial maxima when the present shelf was land and has been reworked by the advancing shoreline. Most shelf morphologic features also reflect these conditions. Modification of the natural pattern of sedimentation has occurred in the Bight apex where man has dumped his wastes for over 60 years. Dredge spoil dumping has created several knolls

on the bottom, and with outfalls, the dumping of sewage sludge, acid wastes, construction, and other rubble, has made the apex a 'worst case' example of ocean pollution. With proper management of municipal and industrial wastes, however, the apex may eventually return to a near-natural setting--still in use by man, but without harmful ecological effects. (NOAA)
W79-06690

CONTROLLING NONPOINT EXTERNALITIES WITH INPUT RESTRICTIONS IN AN IRRIGATED RIVER BASIN,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
G. H. Pfeiffer, and N. K. Whittlesey.
Water Resources Bulletin, Vol. 14, No. 6, p 1387-1403, December 1978. 4 fig, 4 tab, 15 equ, 17 ref. OWRT B-059-NEB (1).

Descriptors: *Nonpoint pollution, *Water pollution control, Economics, Irrigation, *Yakima River Basin(Washington), Linear programming, Simulation analysis, Mathematical models, Sediments, Return flow, Nitrogen, Surface waters.

Irrigated agriculture is a major nonpoint source of surface water quality degradation. Nonpoint source discharges can be controlled by either output taxes or restrictions, or by input taxes or restrictions. The economic theory of externality control with taxes or restrictions on input use is developed. The effectiveness of alternative output control policies in improving surface water quality is demonstrated with a mathematical model of the agriculture and water quality in the Yakima River Basin, Washington. A linear programming model of the farm sector of the Basin in conjunction with a simulation model of environmental quality has been constructed, considering river nitrogen concentration, water temperature, and cropland soil losses. Producer and social abatement costs are the most important measures of policy effectiveness. Sediment loss and river temperature are functionally related to water use. Nitrogen concentration is controlled most efficiently by controlling the use of both fertilizer and water, while sediment and temperature are reduced most efficiently by reducing irrigation water use. (Bell-Graf--Cornell)
W79-06728

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
For primary bibliographic entry see Field 5G.
W79-06735

RELATIONSHIPS BETWEEN CONCENTRATIONS AND DISCHARGE ON SELECTED ILLINOIS STREAMS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
L. J. Vendl.
Report of Investigations, No. 17, January 1979. 32 p, 8 fig, 2 tab, 37 ref, 1 map.

Descriptors: *Streams, *Water quality, *Illinois, *Watersheds(Basins), Discharge(Water), Data collections, Analytical techniques, Alkalinity, Turbidity, Dissolved solids, Ammonia, Nitrogen, Metals, Iron, Fluorides, Silica, Hydrogen ion concentration, Phosphates, Potassium, Boron, Calcium, Chlorides, Copper, Sulfates, Coliforms, Magnesium, Manganese, Nitrates, Sodium, Total dissolved solids, Barium.

All naturally occurring stream waters contain dissolved materials. By analyzing chemical concentration behavior with respect to discharge, one can begin to answer some major questions concerning the dissolved mineral concentration: (1) What effects do changing discharge conditions have on a chemical constituent's concentration. (2) How do changing seasonal discharges effect concentration of these constituents. (3) What can be said about the source (namely base flow, shallow groundwater, surface runoff, point sources and non-point sources) of the constituent by analyzing the discharge and concentration relationships. In this study, 23 constituents were analyzed using a graphical and descriptive approach in order to answer these questions concerning concentration and water discharge relationships. In an attempt to evaluate the differences between water chemistry, physiography, climate, geology, land use, and drainage characteristics, 4 representative drainage basins were selected for study. These are the Fox River above Algonquin, the Sangamon River above Mahomet, the Little Wabash River above Carmi, and the Big Muddy River above Murphysboro. Most constituents showed a seasonal variation in concentration. Variations in the concentration of each constituent from basin to basin reflect the combination of many factors including the type, magnitude, and sources (such as natural or anthropogenic) of each constituent and the assimilation capacity and discharge conditions of the given stream. (Humphreys-ISWS)
W79-06737

BIOLOGICAL IMPLICATIONS OF METALS IN THE ENVIRONMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-750 929, Price codes: A99 in paper copy, A01 in microfiche. Report No. ERDA Symposium Series 42, June 1977. Proceedings of Fifteenth Annual Hanford Life Sciences Symposium at Richland, Washington, September 29-October 1, 1975. 691 p, 259 fig, 175 tab, 1344 ref.

Descriptors: *Metals, *Trace elements, *Biochemistry, Animal metabolism, Plant tissues, Soils, Sediments, Water, Water analysis, Water chemistry, Fertilizers, Animal growth, Ecosystems, Foods, Food chains, Heavy metals, Sewage sludge, Land use, Environmental effects, Mathematical models, Adsorption.

Forty papers by scientists engaged in research programs on trace metals in the environmental and biological areas are presented. The metals mercury, platinum arsenic, zinc, copper, lead, cobalt, silver, iron, manganese, and selenium are discussed. The topics covered include uptake of these metals by plants and animals; the forms of trace elements in soils, sediments and water; adsorption of metals; fallout of toxic metals; metal toxicity to a biological system; heavy metal content of vegetable species grown in soil amended with sewage sludge; heavy metal contaminants in fertilizers; trace metals in ecosystems; and the ecological and land-use relationships of toxic metals. A mathematical model to simulate metal uptake by plants growing in soil is presented. Each paper is accompanied by an abstract and list of references; an index is provided. (Davison-IPA)
W79-06787

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06814

EVALUATION AND CORRELATION OF WATER-QUALITY DATA FOR THE NORTH FORK FLATHEAD RIVER, NORTHWESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 702, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-111, November 1978. 95 p, 22 fig, 10 tab, 18 ref.

Descriptors: *Water quality, *Streamflow, *Sediment transport, *Montana, Dissolved solids, Specific conductivity, Trace elements, Evaluation, Regression analysis, Correlation analysis, Computer programs, Baseline studies, Land use, *North Fork Flathead River(Mont), British Columbia, Alberta.

This report is a compilation and evaluation of water-quality measurements that have been made by the U.S. Geological Survey at two stations on the North Fork Flathead River in Montana. Historical streamflow records show an annual mean daily discharge of 3,010 cubic feet per second near the mouth--a threefold increase compared to discharge at the international boundary. The chemical character of the water is dominated by calcium and magnesium cations and the bicarbonate anion. Base flow, in contrast to high flows from runoff, is characterized by higher dissolved constituents and lower concentrations of suspended sediment. The several lakes that contribute water throughout the middle and lower drainage have a dampening effect on both streamflow and constituent concentrations. Using the available data and computer techniques, regression equations were developed between certain water-quality variables. (Woodard-USGS)
W79-06816

METHANE MIGRATION AROUND SANITARY LANDFILLS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
C. A. Moore, S. R. Igbal, and A. A. Alzoydi.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. GT2, February, 1979. 12 fig, 2 tab, 17 ref, 1 append.

Descriptors: *Computer models, *Methane, *Landfills, *Migration, Groundwater, Water table, Hazards, Explosions, Forecasting, Flow, Gases, Finite element analysis, Charts.

The decomposition of refuse in sanitary landfills results in the generation of methane gas which, when mixed with air, creates an explosion hazard for buildings near landfills. A study was undertaken to develop predictive models for methane migration around landfills using combined transition region multicomponent flow of gases in porous media. A user oriented finite difference code was developed to describe methane migration. Input data consists of landfill geometry, soil type, gases, decomposition history, time steps, program termination, and frequency of printout. The output shows methane concentrations as a function of position. For complex soil configurations, a finite element computer model was developed using axisymmetric geometry and isoparametric elements to define the distribution of soil types. The predictive models have received limited field verification based on data available in the literature. Verification under more controlled conditions is needed to establish reliability of the models. (Purdin-NWWA)
W79-06843

EFFECT OF UPGRADING A MUNICIPAL WASTEWATER EFFLUENT ON POLLUTION INDICATOR AND OTHER MICROORGANISMS IN RIVER WATER,
Connecticut Univ., Noank. Marine Research Lab.
E. A. Matson, S. G. Hornor, and J. D. Buck.
Environmental Science and Technology, Vol. 13, p 460-465, April 1979. 5 fig, 6 tab, 48 ref. OWRT A-052-CONN(19). 14-34-001-9007.

Descriptors: *Microorganisms, *Coliforms, *Yeasts, *Activated sludge, Chlorination, Rivers, *Bioindicators, Municipal wastes, *Sewage treatment, Streptococci, Bacteria, Willimantic/Shetucket River, Connecticut.

Densities of total and fecal coliforms, fecal streptococci, plate count bacteria, and certain yeasts were monitored in an eastern Connecticut watershed for 1 year prior to upgrading a municipal primary settling treatment plant to activated sludge and sampling was continued for 19 months afterward. Substantial reductions in densities of indicator and other bacteria and yeasts upstream of the effluent after upgrading were associated with lower annual precipitation and reduced precipitation-associated sampling. The effluent dilution decreased from 0.84 to 1.42% of river volume due to increased daily treatment plant discharge and decreased river

discharge. Calculated reductions in effluent discharge of indicators ranged from 10% (total coliforms) to 84% (fecal coliforms), while the discharge of 'total plate count bacteria' increased 500%. Chlorination procedures were still required to reduce river total coliform densities below the accepted limit. Within the microbiological perspective, upgrading this treatment plant was of limited value to potential water users. (deLara-Conn)
W79-06856

SOME PROBLEMS IN EVALUATING THE ABILITY OF STRATA TO STORE OR TRANSMIT POLLUTANTS,
Manchester Univ. (England). Dept. of Civil and Structural Engineering.
F. T. Howell.
Water Services, Vol. 82, No. 992, p 668-672, October, 1978. 8 fig, 23 ref.

Descriptors: *Water pollution, *Groundwater, *Migration, *Storage, Aquifers, Permeability, Geologic investigations, On-site investigations, Evaluation, Forecasting, Risks, Pollutants.

Ground water pollution includes any changes in ground water quality which are detrimental to present or future users. If pollutants are placed on, or in the ground, they may migrate or remain in storage depending upon the local hydrogeologic conditions. Problems and errors that occur in the geotechnical investigation, interpretation, and prediction of future changes in these conditions are examined in detail. The consequences of incorrect prediction of the migration or storage properties of strata depend not only upon the magnitude of the error, but also upon the nature of the pollutant and its location in the total environment. In the case of predicting migration, any errors are concerned with the rate of migration, direction, and longevity of the pollution. In the storage situation, the strata or barriers are expected to remain impermeable and prevent the migration of highly toxic fluids. Any activity involving underground pollutants contains an element of risk. However, this must not be used as an excuse to reject proposals concerning pollutants in strata. Nevertheless, it is imperative that decisions are formulated in the full light of the correct appraisal of the ability of the strata to transmit or store pollutants during the lifespan of their effectiveness. (Purdin-NWWA)
W79-06862

AN ENVIRONMENTAL SURVEY OF CANTON ATOLL LAGOON, 1973,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06881

WATER COMPOSITION AND BIOGEOCHEMICAL GRADIENTS IN THE CANTON ATOLL LAGOON,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06883

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
For primary bibliographic entry see Field 8A.
W79-06897

WATERBORNE DISEASE - A STATUS REPORT EMPHASIZING OUTBREAKS IN GROUND WATER SYSTEMS,
Health Effects Research Lab., Cincinnati, OH.
G. F. Craun.
Ground Water, Vol. 17, No. 2, p 183-191, March-April, 1979. 8 tab, 27 ref.

Descriptors: *Diseases, *Water supply, *Groundwater, Water pollution, Water treatment, Municipal water, Statistics.

Between 1971 and 1977 a total of 192 outbreaks of waterborne disease affecting 36,757 persons were reported in the United States. An etiological agent was determined in only 43% of the outbreaks. Giardiasis was more common in surface water system while Shigellosis occurred more often in ground water systems. More outbreaks occurred in nonmunicipal water systems (70%) than municipal-water systems, however, more illness (67%) resulted from outbreaks in municipal systems. Nearly half of the outbreaks (49%) and illness (42%) were caused by the use of untreated or inadequately treated ground water. Contamination by sewage effluent, primarily from septic tanks or cesspools, was responsible for 42% of the outbreaks and 71% of the illness caused by use of untreated ground water. The major causes of outbreaks in municipal systems were contamination of the distribution system and treatment deficiencies which accounted for 68% of the outbreaks and 75% of the illness occurring in municipal systems. Use of untreated ground water was responsible for only 10% of the municipal system outbreaks and 1% of the illness. Inadequate and interrupted treatment or lack of treatment of ground water sources were responsible for 78% of the outbreaks and 94% of the illness in nonmunicipal-water systems. (Purdin-NWWA)
W79-06909

HEAVY METAL CONTAMINATION OF SURFACE WATERS AND FISH FLESH IN SOUTH CAROLINA,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. R. Abernathy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 215, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Report No. 74, March 1979. 119 p, 6 fig, 29 tab, 120 ref, 3 append. OWRT A-032-SC(4).

Descriptors: *Heavy metals, Water pollution effects, Mercury, Cadmium, Arsenic, Reservoirs, *Surface water, *Fish, South Carolina, Lake Keowee, Lake Jocassee.

A study was made from July 1974 to June 1976 of the major reservoirs in South Carolina for mercury, cadmium, and arsenic in water, sediments, and fish flesh. Mercury was found to exceed the FDA action level of 0.5 ppm in flesh of fish taken from Lakes Keowee and Jocassee. Most fish from other waters had concentrations of mercury lower than 0.5 ppm. No unusual concentrations of mercury were found in water or sediments. Local concentrations of cadmium were found in a stream receiving plating wastewater, but no other problems of high concentrations of cadmium or arsenic were located.
W79-06914

SIZE DEPENDENT MODEL OF HAZARDOUS SUBSTANCES IN AQUATIC FOOD CHAIN,
Manhattan Coll., Bronx, NY.
R. V. Thomann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 009, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-036, April 1978. 48 p, 11 fig, 7 tab, 45 ref. R803680030.

Descriptors: *Path of pollutants, *Food chains, *Water pollution, *Mathematical models, Ecosystems, Aquatic animals, Aquatic habitats, Equations, Analytical techniques, Tracking techniques, Ecology, Food webs, Lake Ontario, Wastes.

A mass balance model using organism size as an independent variable is constructed to track bioaccumulation of toxic substances in freshwater ecosystems and subsequent transfer up the food chain. Since this model represents size dependent ecological continuum, classical compartment analyses becomes a special case. Size dependence is viewed as an approximate ordering of trophic position. To illustrate this theory the analysis of some PCB data in Lake Ontario was used with a completely mixed water volume; PCB data on net plankton, alewife, smelt, sculpin and coho salmon were used. Preliminary estimates of the model coefficients were made with the field data and laboratory data from the literature. The results indicated that about 30% of the observed 6.5 micrograms of PCB/gram fish at the coho salmon size range was due to transfer from lower levels in the food chain and about 70% was due to direct water intake. The rapid accumulation of PCB with organism size as shown by the model, was due to decreased excretion rates and decreased biomass at higher trophic levels. It is concluded that this equation permits rapid solution for the distribution of the toxicant throughout the food chain, but the present form of the size dependent model does not permit detailed analysis on any one segment of the ecosystem. (Davison-IPA)
W79-06954

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 9. THE SYNTHETIC RUBBER INDUSTRY,
Radian Corp., Austin, TX.
J. Parr, T. B. Parsons, and N. P. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 480, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-023i, 1977. 92 p, 3 fig, 45 tab, 50 ref, 3 append.

Descriptors: *Industrial wastes, *Synthetic rubber, *Organic compounds, *Water pollution sources, *Organic wastes, Chemical wastes, Industrial water, Operations, Industrial production.

The environmental impacts of the synthetic rubber industry are examined. Emulsion crumb production processes are described including: monomer storage, caustic wash, polymerization, light monomer recovery, heavy monomer recovery, coagulation and screening, and crumb washing, drying, and finishing. Latex production processes are described including polymerization, light monomer removal, heavy monomer removal, and blending, storage, and shipping. Solution crumb production processes include feed drying, polymerization, cement storage, stripping and coagulation, monomer and solvent recovery, and dewatering and product finishing. The largest source of pollution is aqueous emissions. Some organic compounds identified in effluents from synthetic rubber plants are 2, benzothiazole, n-butylisothiocynate, bis-2-chloroethyl-ether, p-dithiane, styrene, and triethylurea. (Small-FRC)
W79-06959

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 12. THE EXPLOSIVES INDUSTRY,
Radian Corp., Austin, TX.
C. E. Hudak, and T. B. Parsons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 641, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-023L, 1977. 125 p, 12 fig, 38 tab, 19 ref, 3 append.

Descriptors: *Industrial wastes, *Water pollution sources, *Explosives, *Waste water, *Organic compounds, Chemical wastes, Air pollution, Solid wastes.

The environmental impacts of the explosive industry are discussed. The explosives industry includes companies which manufacture organic nitration products and formulate mixtures of chemicals with explosive properties. Five nitration processes are described: TNT production processes, Nitrocellulose production processes, RDX/HMX production processes, Nitroglycerin production processes, and Pentaerythritol Tetranitrate production processes. Also, the production of nitric acid is described. Liquid wastes from these processes contain various significant pollutants and potential pollutants. Six process flow charts and fifteen process descriptions are presented to characterize the industry. Input materials, operating parameters, utility requirements, and waste streams are described. In addition to waste water problems, air pollution and solid waste disposal problems are considered. (Small-FRC)
W79-06960

NDUSTRIAL PROCESS PROFILES FOR EN-VIRONMENTAL USE: CHAPTER 13. PLASTI-CIZERS INDUSTRY,
Radian Corp., Austin, TX.
C. M. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 642, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023m, 1977. 84 p, 3 fig, 15 ab, 22 ref, 3 append.

Descriptors: *Industrial wastes, *Plastics, *Waste water, *Biochemical oxygen demand, *Suspended olids, Chemical oxygen demand, Copper, Oil, Carbon, Chlorides, Waste water treatment.

The environmental impacts of the plasticizer indus-ry are catalogued including the activities of manu-acturers who produce primary synthetic organic lasticizers. Three process flow sheets and three rocess descriptions characterize the industry. Data are presented on input materials, operating arameters, utility requirements, and waste treams. The synthetic plasticizer processes de-ailed are: esterification of carboxylic acids, pro-luction of phosphate esters by esterification, and poxidation. Waste water is the major environmen-al problem. Waste water from esterification of arboxylic acids can contain dilute caustic, addi-ives, sulfates, and organics such as alcohols, mon-ester, and small amounts of product. A tricresyl-hosphate plant had a higher waste water flow and uch lower loadings for biochemical oxygen emand, chemical oxygen demand, total organic arbon, cyanide, oil, copper, and total dissolved olids, than those for a diethylphthalate plant. Sul-ate loads were comparable for the two processes, nd chloride loads were high for the tricresylphos-hate process. Problems can be avoided with roper waste water treatment. (Small-FRC)
W79-06961

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 11. THE SYNTHETIC FIBER INDUSTRY,
Radian Corp., Austin, TX.
J. L. Parr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 481, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023k, 1977. 56 p, 1 fig, 22 tab, 68 ref, 3 append.

Descriptors: *Textiles, *Industrial wastes, *Waste water, *Solvents, *Lubricants, Sewage, Cooling water, Organic compounds, Waste water treatment, Industrial production.

The environmental impacts of the synthetic fibers industry are examined. Fiber processes are described including: melt spinning, wet spinning, dry spinning, lubrication, drawing, and fiber modifications. Liquid emissions represent the largest potential source of pollutants. These are generally spin-finish wastes and include water used for purging the spinning baths and washing the filaments, lubricants used in finish applications, and solvent wastes from dry and wet spinning. There are also sanitary wastes resulting from the large number of employees, and cooling water blowdown. Waste water emissions are classified according to waste load and treatability. Analysis of samples from a settling pond at an acrylic fibers production facility determined the presence of acrylonitrile (100 mg/liter), 2,8-dibromo-1-propanol (0.5 mgl/liter), an isomer of dibromopropene, and 2,4-dimethyldiphenyl-sulfone. (Small-FRC)
W79-06962

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 19. THE CLAY INDUSTRY,
Dow Chemical Co., Freeport, TX.
J. T. Reding, K. E. Bishop, P. E. Muehlberg, and B. P. Shepherd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 486, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023s, 1977. 61 p, 3 fig, 6 tab, 29 ref, 3 append.

Descriptors: *Industrial wastes, *Clays, Water pollution sources, *Settling basins, *Suspended solids, Solid wastes, Air pollution, Industrial production, Operations, *Mining.

The environmental impacts of the clay industry are discussed, and industrial processes are described. Clay production and brick manufacture are considered separately. One chemical tree, two process flow sheets, and nine process descriptions characterize the industry. The process descriptions are: mining, crushing, drying, dry grinding, wet concentrating, final drying, extruding, brick drying, and firing. Water pollution is a major environmental problem. As overburden is removed and clay is mined, water percolates through the soil. It becomes high in suspended solids and is usually discharged into nearby streams. A sump or settling basin for the percolating water can solve the problem. Dust emissions are a minor problem. Generated solid wastes are largely used for landfill. In 1973 kaolin clay mining generated approximately 30,000,000 to 40,000,000 metric tons of waste, while common clay mining generated 10,000,000 to 15,000,000 metric tons of waste. (Small-FRC)
W79-06963

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 2. OIL AND GAS PRODUCTION INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5A.
W79-06984

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 7. ORGANIC DYES AND PIGMENTS INDUSTRY,
Radian Corp., Austin, TX.
T. R. Steadman, E. W. Helper, T. Parsons, G. E. Wilkins, and N. P. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 479, Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-77-023g, 1977. 362 p, 76 fig, 7 tab, 5 append.

Descriptors: *Dyes, *Organic compounds, *Pigments, *Industrial production, *Toxicity, Effluent streams, Solid wastes, Air pollution, Brines, Acids, Alkalis(Bases), Color, Metals, Catalysts, Chemical reactions, Waste water disposal, Industrial wastes, Chemical wastes.

Processes associated with the organic dyes and pigments industry are described and their waste streams are characterized. The processes generate solid, liquid, and gaseous wastes. Large volumes of toxic liquid wastes originate from chemical reaction by-products; physical separation techniques such as crystallization, filtration, and washing; and from equipment cleaning methods. The effluent streams are composed of brine solutions and dilute acids and bases contaminated with toxic and/or explosive organic compounds of highly colored dyes or intermediates. Metals or metal salts used as catalysts for various reactions are also present in the waste waters. Specific composition of the effluents is dependent upon the dye or pigment being manufactured. The high cost of treating and controlling these wastes has caused some companies to terminate production of some dyes and pigments. Gaseous emissions generated by this industry include nitrogen oxides, sulfur oxides, hydrogen sulfide, hydrogen chloride, and organic vapors such as amines, phosgene, and formaldehyde. Solid wastes generated include distillation residues, particulates from baghouses, filter paper, and activated carbon. Forty-two chemical trees, 34 process flow sheets, and 48 process descriptions were prepared. Company, product, and raw material data are also included. (Lisk-FRC)
W79-06985

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 10. PLASTICS AND RESINS INDUSTRY,
Radian Corp., Austin, TX.
G. F. Wilkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 640, Price codes: A15 in paper copy, A01 in microfiche. Report EPA-600/2-77-023j, 1977. 351 p, 22 fig, 121 tab, 84 ref, 3 append.

Descriptors: *Plastics, *Resins, *Chemical wastes, *Industrial production, *Pollutant identification, *Organic compounds, Effluent streams, Air pollution, Cooling towers, Boilers, Solid wastes, Waste water treatment, Industrial wastes.

Processes, operations, and wastes of the plastics and resins industry are detailed. The industry converts monomer or chemical intermediate materials into resinous polymer products. The report includes 20 process flow sheets, and 60 process descriptions incorporating data on input materials, operating parameters, utility requirements, and waste streams. Aqueous waste streams originate from processing streams which are in direct contact with water; from chemical reactions; from cleaning process equipment, area maintenance, utility boilers, and cooling water blowdown; and laboratories. Pollutants found in the waste waters include organic reactants, monomers, oligomers, polymers, and salts. Gaseous emissions are primarily hydrocarbons and specifically, vinyl chloride, toluene disocyanate, phosgene, pyridine, olefins, aromatics, paraffins, and naphthenes. Solid wastes, such as captured particulates and fines, and plastic wastes, are landfilled, incinerated, or recycled. Waste waters produced by cooling towers, refrigeration, and steam generation facilities, may contain toxic anti-corrosion chemicals such as chromium compounds and anti-fouling agents; these effluent streams are usually combined for discharge to treatment plants. (Lisk-FRC)
W79-06986

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 26. TITANIUM INDUSTRY,
Radian Corp., Austin, TX.
V. S. Katari, and T. W. Devitt.
Report EPA-600/2-77-023z, 1977. 65 p, 2 fig, 21 tab, 50 ref, 3 append.

Descriptors: *Titanium, *Industrial production, *Effluent streams, *Mine wastes, *Industrial wastes, Sludge disposal, Acidity, Neutralization, Waste treatment, Sulfur compounds, Operations.

An analysis of the titanium industry producing titanium metal and titanium dioxide is presented. Two industrial process flow sheets and 11 process descriptions incorporating data on input materials, operation parameters, utility requirements, and waste streams were prepared to characterize the titanium industry. The industry generates large quantities from the mining and concentrating of titanium and the production of titanium dioxide. The wastes consist primarily of weak sulfuric acid and their disposal represents a major environmental problem. The wastes are disposed of by sea dumping after neutralization treatment. In 1972, US titanium dioxide plants produced about 1.7 million metric tons of iron-acid sludge and 146 thousand metric tons of iron-chloride sludge. Particulate emissions are also associated with the titanium industry. The mining and beneficiation of ilemenite and the production of titanium dioxide pigment result in emissions. Sulfur dioxide mist, particulate emissions, or chloride emissions are generated by the various calcination processes. (Lisk-FRC)
W79-06987

FATE OF BIOLOGICALLY ACCUMULATED COPPER IN GROWING AND DECOMPOSING THALLI OF TWO BENTHIC RED MARINE ALGAE,
Fundacao Univ. do Rio Grande (Brazil). Base Oceanografica Atlantica.
U. Seeliger, and P. Edwards.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, No. 1, p 227-238, 1979, 3 fig, 1 tab, 42 ref.

Descriptors: *Environmental effects, *Path of pollutant, Pollutants, Copper, Algae, Absorption, Uptake(Biological), Marine animals, Food chains.

In order to investigate uptake and subsequent release of Cu by both living and decompising thalli, Ceramium pedicellatum and Neogardhiella baileyi were cultured for 30 days in 1.4, 6.4 and 11.4 microg/l Cu in dissolved inorganic form. Concentration factors of Cu found in thalli ranged from 4540 (N. baileyi in 6.4 microg/l) to 6864 (C. pedicellatum in 1.4 microg/l). Up to 22% of the Cu in the thalli was bound to dissolved organic sites during dissolved organic matter (DOM) release while only 3-10% was released in the dissolved inorganic form. After 100 days of degradation, under axenic conditions with no bacterial activity occurring, 80-90% of the Cu was associated with organic dissolved or particulate fractions. It was concluded that the majority of Cu incorporated into the living algal thallus will eventually become available to marine consumers. (Chilton-ORNL)
W79-06988

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 6. THE INDUSTRIAL ORGANIC CHEMICALS INDUSTRY,
Research Triangle Inst., Research Triangle Park, NC.
R. Liepins, F. Mixon, C. Hudak, and T. B. Parsons.
Report EPA-600/2-77-0231, 1977. 1014 p, 20 fig, 12 tab, 600 ref, 5 append.

Descriptors: *Environmental effects, *Chemical industry, *Chemical wastes, *Evaluation, *Water pollution sources, Organic compounds, Waste water.

The environmental impacts of the industrial organic chemicals industry are presented. The industry is considered in terms of ten feedstock groups: benzene, butylenes, sources of cresylic acids, ethylene, methane, naphthalene, paraffins, propylene, toluene, and xylene. Ten chemical trees, ten process flow sheets, and 365 process descriptions characterize the industry. Within each process description, available data are presented on function, input materials, operating parameters, utilities, waste streams, EPA Source Classification Code, and references. Company, product, and raw material data are included as appendices. (Small-FRC)
W79-06989

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 15. BRINE AND EVAPORITE CHEMICALS INDUSTRY,
Radian Corp., Austin, TX.
P. E. Muehlberg, B. P. Shepherd, J. T. Redding, and H. C. Behrens.
Report EPA-600/2-77-0230, 1977. 324 p, 24 fig, 8 tab, 150 ref, 3 append.

Descriptors: *Environmental effects, *Chemical industry, *Chemical wastes, *Brines, *Inorganic compounds, Water pollution sources, Waste water, Sea water, Saline lakes.

The environmental impacts of the brine and evaporative chemicals industry were evaluated. The industry encompasses all first-level inorganic compounds derived from subterranean brines, from existing or historic salt lakes, and from sea water. Six segments of the industry are discussed: borax and borix acid, chlorine-caustic, lithium chemicals, magnesium chemicals, potash, and sodium metal. The industry is characterized by one chemical tree, 22 process flow sheets, and 67 process descriptions. Within each process description, input materials, operating parameters, utility requirements, and waste streams are described. Company, product, and raw material data are included as appendices. (Small-FRC)
W79-06990

RESULTS OF AN ALGAL TOXICITY TEST APPLIED TO SEDIMENT ELUTRIATES,
Naval Research Lab., Washington, DC.
P. J. Hannan, and C. E. Patouillet.
NRL Memorandum Report 3952, 1979. 24 p, 2 fig, 8 tab, 23 ref.

Descriptors: *Sediments, *Toxicity, *Algae, *Growth rates, *Eluvium, Water pollution, Laboratory tests, Copper.

The effect of sediments from various marine and estuarine sites on the growth rate of the alga, Phaeodactylum tricornutum, was investigated. Cultures were grown in solutions of one part Guillard and Ryther medium and 11 parts sediment elutriate. Algae growth was monitored by fluorescene measurements over a 2-day period. Generally, there was a prolongation of the lag phase of growth, and there were a few cases in which the elutriates were highly toxic. The concentration of the incoulum was a factor in the algae response. With a heavy inoculum (over 30 ppm packed cell volume), a group of sediment elutriates promoted growth, but in the presence of very dilute inocula, these same elutriates provided less growth than the controls. Some sediment elutriates did not reduce the toxicity of sublethal concentrations of Cu(+2), while others did. Also, prolonged storage of sediments at refrigerator temperatures decreased the capacity of certain sediments to reduce the toxicity of Cu(+2) when combined with elutriates. Variations in toxicity were demonstrated in sediments with close proximity to each other in Puerto Misquito Bay, Puerto Rico. (Small-FRC)
W79-06992

5C. Effects Of Pollution

LAKE SUPERIOR ORGANIC CARBON BUDGET,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
W. J. Maier, and W. R. Swain.
Water Research, Vol 12, No 6, p 403-412, 1978. 6 fig, 4 tab, 19 ref. B-139-MINN(1). 14-34-0001-8092.

Descriptors: *Lake Superior, *Great Lakes, *Organic carbon, *Nutrient budgets, *Mathematical models, *Water pollution sources, *Water quality indices, Lakes, Carbon, Total organic carbon, Mass balance, Model studies, Indicators, Nutrients, Photosynthesis, Watersheds(Basins), Rainfall, Sedimentation, Precipitation(Atmospheric), Runoff, Primary productivity, Surface runoff coefficient, Industrialization, Urbanization, Fallout, Air pollution effects.

Analysis of the organic carbon budget for Lake Superior with a simple mathematical model treating the lake as a well-mixed basin shows that watershed runoff, precipitation, and in-situ photosynthetic production are major sources of inflow that could ultimately lead to significant deterioration of water quality. Large yearly inflows of organic matter, whose effect on total organic carbon (TOC) concentration is muted because of dilution in the large lake, could become significant in the long run with persistent small increases which are difficult to verify experimentally. Should industrialization double runoff coefficients, yearly TOC increase would be less than 0.05 mg/l, but lake concentration could reach gross pollution levels (five mg/l) in less than 70 years. Influx of organic matter from watershed drainage is described in this study in terms of surface area and a surface runoff coefficient (SROC) characterized by topographical-hydrological factors and the level of industrial-urban activity. The St. Louis River watershed has the highest SROC (7.5 g/sq m/yr), while undeveloped watersheds have SROCs of 3.4-5.0 g/sq m/yr. TOC influx from the atmosphere as rainfall or dry fallout is probably low (0-3 mg/l) at present, but an increase to 9.4 mg/l (typical of industrial areas) would increase the lake's carbon burden by an amount equal to the tributary runoff associated with an SROC of five gm/sq m/yr. Net yearly accumulation of organic carbon from photosynthetic primary production is undoubtedly small. (Lynch-Wisconsin)
W79-06504

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978, VOLUME I.
December 1978. 504 p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Resources development, *Water pollution effects, *Environmental effects, Mammals, Birds, Fish, Microbiology, Ecosystems, *Outer Continental Shelf, *Ecological distribution, Receptors, Petroleum development, Quarterly reports.

Quarterly reports delineate objectives and progress in baseline studies designed to assess the environmental impact of resources development on Alaska's Outer Continental Shelf. Emphasis is on organizing ecological distributions. (See also W79-06511) (Sinha-OEIS)
W79-06510

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978, VOLUME II.
For primary bibliographic entry see Field 5B.
W79-06511

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS OCTOBER - DECEMBER 1978. VOLUME I.
March 1979. 628 p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Resources development, *Environmental effects, *Water pollution effects, Mammals, Birds, Fish, Microbiology, Ecosystems, *Outer Continental Shelf, Receptors, Petroleum development, Quarterly reports.

This volume contains numerous brief quarterly reports of work in progress or planned which examines the environmental effects of various activities and developments on the Outer Continental Shelf of Alaska with respect to - receptors such as marine mammals, birds, fish and microbiology. Studies on specific effects and contaminant baselines are encompassed. (See also W79-06513) (Sinha-OEIS)
W79-06512

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS OCTOBER - DECEMBER 1978. VOLUME II.
For primary bibliographic entry see Field 5B.
W79-06513

PASSAGE OF ANTICYCLONIC GULF STREAM EDDIES THROUGH DEEPWATER DUMPSITE 106 DURING 1974 AND 1975,
National Marine Fisheries Service, Narragansett, RI. Atlantic Environmental Group.
For primary bibliographic entry see Field 5B.
W79-06514

NATURAL GAS SEEPAGE ON THE SOUTH TEXAS SHELF,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5B.
W79-06517

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
For primary bibliographic entry see Field 5B.
W79-06518

AT-SEA DISCHARGE OF OCEAN MINING PROCESS REJECTS - AN ALTERNATIVE TO LAND DISPOSAL,
For primary bibliographic entry see Field 5B.
W79-06519

A COLLISION AVOIDANCE SYSTEM FOR OFFSHORE OPERATIONS,
For primary bibliographic entry see Field 5B.
W79-06520

ECOLOGICAL INVESTIGATIONS OF PETROLEUM PRODUCTION PLATFORMS IN THE CENTRAL GULF OF MEXICO - PRELIMINARY FINDINGS,
C. A. Bedinger, Jr.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2149-2161, 6 fig, 5 tab, 13 ref, OTC No 3605. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Ecology, *Offshore platforms, *Water pollution effects, *Gulf of Mexico, Environmental effects, Oil pollution, *Outer Continental Shelf, Petroleum development.

Southwest Research Institute is presently managing a relatively large program in offshore ecology for the Bureau of Land Management. Project objectives are to assess the long term cumulative effects of production platform operation on the Outer continental shelf (OCS) environment, and further define their 'artificial reef' effect. These results are then to be used in helping formulate future research on the OCE, indicate monitoring techniques and, to review present 'benchmark' studies. The study area covers a broad expanse of the Louisiana 'oilpatch' from the Mississippi delta, west 200 miles and offshore 100 miles. Twenty-four stations have been visited during late spring and late summer, 1978, and winter, 1979, with four platforms sampled as primary sites during each season, 16 as secondary sites in the late summer and four controls in each season. The program was designed to cover all production types, ages and surrounding ecosystems normal to the northcentral Gulf of Mexico. Collections and analyses have included basic hydrography; hydrocarbons in water, sediments and biota; trace metals from similar samples; sediment physical characterization; benthic microbiology; benthic biota; histopathology in fish and invertebrates; and platform associated fouling organisms and fish. This paper presents data from initial sampling and gives observations of trends. The major observations realized are that the Mississippi River overshadows man's activities in affecting the environment in that it overrides ocean water over a considerable area in the nearshore during the summer months causing an oxygen decline and subsequent dieoff and emigration of organisms. (Sinha-OEIS)
W79-06521

AN INDEPENDENT APPRAISAL OF THE OFFSHORE ECOLOGY INVESTIGATION,
M. E. Bender, J. M. Sharp, D. J. Reish, S. G. Appan, and C. H. Ward.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2163-2172, 6 fig, 4 tab, 11 ref, Oct No 3606. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Monitoring, *Ecology, *Louisiana, *Water pollution effects, *Oil pollution, Environmental effects, Resources development, Baseline studies, Gas, Drilling, *Outer Continental Shelf, Petroleum development, Oil and gas production.

The Offshore Ecology Investigation (OEI) was conducted over a two-year (June 1972 - January 1974) eight-season period in the Timbalier Bay and offshore region of the 'Louisiana Oil Patch'. It consisted of 23 biological, chemical, physical, and geological investigations coordinated in space and time in an effort to detect any cumulative effects on the bay and offshore ecosystems resulting from 35 years of intensive oil and gas drilling and production. The individual Principal Investigators' data, reports, and conclusions were synthesized and interpreted by a four-member Council. During the past year, the logic and rationale employed and the data and conclusions drawn for the OEI were evaluated by three environmental scientists who were not involved in the conduct of the study. The evaluation was conducted using computer-assisted methods which permitted unconstrained and completely selective access to, and display of, all of the OEI data. This paper presents the results of that analysis in terms of (1) the validity and the adequacy of the data to support the 1974 OEI consensus conclusions, (2) the validity of, and basis for, those conclusions, and (3) general recommendations for monitoring methodologies. (Sinha-OEIS)
W79-06522

AN INTRODUCTION TO THE OILSPILL RISK ANALYSIS MODEL,
For primary bibliographic entry see Field 5B.
W79-06523

THE MIXING OF OIL SPILLS INTO THE SEA BY BREAKING WAVES,
A. Naess.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2193-2204, 11 fig, 2 tab, 9 ref, OCT No 3610. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil spills, *Waves(Water), *Mixing, *Model studies, Resources development, Environmental effects, Water pollution effects, Baseline studies, *Outer Continental Shelf, Petroleum development.

A problem of considerable importance to pollution control out on the high seas is the mixing of an oil spill into the sea caused by breaking waves. In this paper a theoretical model is proposed that represents a fruitful approach to the problem of determining the amount of oil mixed into the sea by breaking waves. The model is based primarily on probabilistic methods, but with experimental observations and data as an essential foundation. In order to illustrate the theoretical model, some numerical examples are given. (Sinha-OEIS)
W79-06525

SOME CAUSES, CONSEQUENCES AND POTENTIAL ENVIRONMENTAL IMPACTS OF OXYGEN DEPLETION IN THE NORTHERN GULF OF MEXICO,
N. Fotheringham, and G. H. Weissberg.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2205-2208, 4 fig, 1 tab, 2 ref, OTC No 3611. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Water quality, *Water pollution effects, *Gulf of Mexico, Oil pollution, Waste disposal, Mortality, Benthos, Environmental effects, Resources development, Baseline studies, *Outer Continental Shelf, *Oxygen depletion, Ocean dumping.

Biological and water quality changes in the Gulf of Mexico off the central Louisiana coast have been examined during a seasonal period of stratification and oxygen depletion in the water column. Probable causes, observed effects, and potential impacts on the timing of ocean discharges and dumping and onsite selection for offshore industries are described. Apparently an annual phenomenon of variable intensity resulting from a large discharge of low salinity, organic-laden water from the Mississippi and Atchafalaya Rivers at a time of minimal vertical mixing, this midsummer event may be intensified and prolonged by the intrusion of high salinity bottom water from a Loop Current eddy. In 1978, a widespread low oxygen layer occupied the lower 3 to 8 m of the 6 to 17 m water column for at least 3 weeks. Dissolved oxygen concentration was commonly less than 0.1 ppm in this layer, resulting in the mortality of some polychaetes, mollusks, and crustaceans, including blue crabs, and in the reduction of demersal shrimp and fish populations, probably through emigration offshore. Numerous large bivalves approximately 4 to 5 years old were killed, indicating an intensity not experienced since 1973 to 1974, when Green found anoxic bottom water at over one-half of his stations in this area. The temporal and geographic distribution of this condition and its environmental consequences should be recognized by industries engaged in fishing, offshore petroleum production, and offshore dumping and by government agencies providing leases and permits for these activities. (Sinha-OEIS)
W79-06526

A SEA-FLOOR SEISMIC MONITORING NETWORK AROUND AN OFFSHORE OILFIELD PLATFORM AND RECORDING OF THE AUGUST 13, 1978 SANTA BARBARA EARTHQUAKE,
University of Southern California, Los Angeles.
For primary bibliographic entry see Field 5B.
W79-06528

ENVIRONMENTAL HAZARDS: CONSIDERATIONS FOR OUTER CONTINENTAL SHELF DEVELOPMENT,
For primary bibliographic entry see Field 5B.
W79-06529

TEMPERATURE TOLERANCE OF LARVAL MUSKELLUNGE (ESOX MASQUINONGY MITCHELL) AND F1 HYBRIDS REARED UNDER HATCHERY CONDITIONS,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
J. D. Bonin, and J. R. Spotila.
Comparative Biochemistry and Physiology, Vol. 59A, No. 3, p 245-248, 1978, 2 fig, 31 ref. ERDA E(11-1)-2502.

Descriptors: *Environmental effects, *Temperature, *Resistance, Fry, Larval growth stage, Fish, Pikes, *Critical thermal maxima.

Muskellunge and norlunge fry were acclimated to as close to natural conditions as possible in lake water with natural diets and photoperiod. Temperature tolerances of the fry were determined during a 53 day period beginning the day after hatching and ending when fry were released to Chautauqua Lake. There was a highly significant difference between the average critical thermal maxima (CTM) of norlunge (34.0C) and muskellunge (32.8C) fry. Both fish exhibited a marked decrease in CTM during swim-up indicating that this is a critical period of development. After swim-up the temperature tolerance of muskellunge fry gradually increased. CTM of norlunge fry followed the same pattern but were higher than those of muskellunge fry. CTM increased in both fry regardless of water temperature. Norlung fry adjusted to changing environmental conditions more readily than muskellunge fry. (Chilton-ORNL)
W79-06530

EFFECTS OF THERMAL LOADING ON BOTTOM INVERTEBRATES IN A SOUTH CAROLINA RESERVOIR,
Clemson Univ., SC. Dept. of Zoology.
C. F. Sigmon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 404, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Institute, Clemson University, Completion Report No. 76, April 1979. 40 p, 5 fig, 7 tab, 35 ref. OWRT B-086-SC (1).

Descriptors: *Benthos, *Heated water, *Water pollution, *Density, *Distribution, *Water pollution effects, Benthic flora, Benthic fauna, Aquatic life, Nuclear reactors, Nuclear powerplants, Temperature, Sampling, Oconee Nuclear Station, Lake Keowe(South Carolina).

The influence of season, depth, station location, water temperature and sediment characteristics on benthos were studied in an investigation of the

effects of operation of the Oconee Nuclear Station in Lake Keowee, South Carolina. The study period, 1971-1976, includes a two year time prior to the start-up of the Station's three 886 megawatt reactors during 1973 and 1974, and the years of intermittant operation of all three reactors. Sediment samples taken at one and 10 m depths at the four stations were analyzed for particle size distribution, benthic samples were collected monthly at the stations, and temperature data was obtained from monitors operated at each station by Duke Power Company. The results include data on species composition, density and headwidths of benthos. During the study period, diversity and density were lower in the discharge canal. Both were caused by reduced organic content of the discharge canal sediments. Temperature did not affect density or diversity, and subtle effect of temperature on growth were not observed. It is concluded that the distribution of those benthos studied is more strongly influenced by sediment characteristics than by temperature. The hypolimnetic intake design aids in minimizing the effects of the thermal effluent on the benthos. The thermal character of the discharge canal does not differ much from that of the epilimnion of the other stations. (Davison-IPA)
W79-06561

KEPONE/MIREX/ HEXACHLOROCYCLOPENTADIENE: AN ENVIRONMENTAL ASSESSMENT.
National Research Council, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 289, Price codes: A05 in paper copy, A01 in microfiche. 1978. 84 p, 2 fig, 9 tab, 100 ref. 68-01-3253.

Descriptors: *Pesticides, *Organic pesticides, *Chlorinated hydrocarbons, *Kepone, *Mirex, *Hexachlorocyclopentadiene, *Environmental effects, Toxicity, Pesticide residues, Chemical wastes, Biochemistry, Animal growth, Marine biology, Aquatic animals, Fish, Human pathology, Soil contamination effects, Water pollution effects, Water pollution sources.

Literature searches conducted by Battelle Columbus Laboratories and the Stanford Research Institute served as a basis for the assessment of the scientific and technical knowledge on the effects of Kepone, mirex and hex as environmental pollutants. Focusing primarily of effects, this study only considers those aspects of transport, transformation, and routes of exposure critical to specific organisms and/or systems. The cyclodiene insecticides Kepone and mirex are synthesized from hexachlorocyclopentadiene (hex). As members of the organochlorine group, Kepone and mirex are generally similar in regard to their chemical characteristics, biological activity, and behavior in the environment. Kepone is environmentally persistent and highly toxic to various organisms. Since it is carcinogenic to laboratory rodents, it is presumed to present a cancer hazard to humans. Mirex has a tendency to bioaccumulate and biomagnify; it degrades into a series of potentially hazardous products including Kepone. It is toxic to human beings, and carcinogenic to laboratory rodents. Hex undergoes bioconcentration and biomagnification in simulated microcosms, thus showing environmental characteristics common to some better known organochlorine compounds. Production is expected to remain at high levels for the manufacture of flame retardants and pesticides for export. The list of research needs identifies where more knowledge is needed to make a truly comprehensive assessment of the effects of these insecticides. (Davison-IPA)
W79-06566

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER.
SCS Engineers, Long Beach, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 482, Price codes: A16 in paper copy, A01 in microfiche. Report No EPA-600/1-78-019, March 1978. 360 p, 4 fig, 113 tab, 716 ref. 68-02-2257.

Descriptors: *Waste water, *Water reuse, *Public health, *Path of pollutants, *Waste water treatment, *Wastes, *Cities, *Waste water disposal, Tertiary treatment, Coagulation, Disinfection, Carbon, Adsorption, Ion exchange, Reverse osmosis, Filtration, Potable water.

A compilation of the available published quantitative data concerning the health effects associated with the reuse of treated municipal waste water is presented. The information includes data on the effectiveness of conventional water and waste water treatment and disposal operations to reduce concentrations of public health contaminants and the transport of these contaminants through the environment to man. The data are organized so that the pollutant paths to man can be evaluated according to public health significance to establish research priorities. Conventional secondary and tertiary waste water treatment processes, and the disposal techniques, direct discharge to fresh surface waters and land application, are evaluated. The water treatment processes evaluated include the conventional treatments, chemical coagulation, with or without filtration, and disinfection, and the advanced water treatments, carbon adsorption, ion exchange and reverse osmosis. Public health considerations are discussed. (Davison-IPA)
W79-06567

THE IMPACT OF BROADLY APPLIED EFFLUENT PHOSPHORUS STANDARDS ON EUTROPHICATION CONTROL,
Corvallis Environmental Research Lab., OR.
J. H. Gakstatter, A. F. Bartsch, and C. A. Callahan.
Water Resources Research, Vol 14, No 6, p 1155-1158, December, 1978. 1 fig, 18 ref.

Descriptors: *Eutrophication, Sewage effluents, Effluents, *Phosphorus, Municipal wastes, Sewage disposal, Model studies, Trophic level.

The potential trophic benefits to lakes and reservoirs of a 1 mg/l and zero-discharge total phosphorus effluent standard for municipal sewage treatment plants were examined by using two phosphorus mass balance models. The analysis included 255 lakes and reservoirs receiving municipal sewage treatment plant effluents and located in the eastern half of the United States. These water bodies, their significant tributaries, and contributing effluents were sampled during the U.S. Environmental Protection Agency's National Eutrophication Survey. Improvement in trophic condition is defined as a predicted decrease of at least 25% in external phosphorus supply, which would cause the predicted in-lake total phosphorus concentration to (1) decrease from greater to less than 40 micrograms/liter but remain above 20 micrograms/liter, (2) decrease from above 20 micrograms/liter to less than 20 micrograms/liter, or (3) decrease from less than 20 micrograms/liter to a lower concentration. Using the definition stated above, the two models indicated that 18-22% of the water bodies would benefit from a 1 mg/l effluent standard. If the requirement were zero phosphorus, 28% of the water bodies would benefit. (Skogerboe-Colorado State)
W79-06642

OCEAN DISPERSAL AS AN ULTIMATE DISPOSAL METHOD,
Philadelphia Water Dept., PA. Water Pollution Control Div.
C. F. Guarino, M. D. Nelson, and S. S. Almeida.
Journal Water Pollution Control Federation, Vol. 51, No. 4, p 773-782, April 1979. 3 fig, 11 tab, 4 ref.

Descriptors: *Waste disposal, *Water pollution effects, *Environmental effects, Sludge disposal, United States, Dispersion, Heavy metals, Bacteria, Polychlorinated biphenyls, *Outer Continental Shelf, *Ocean dumping, *Brazil.

The use of ocean dispersal as an ultimate disposal method for wastewater sludges will end in the United States by 1981. Ocean disposal of sludge has come under attach in the United States from both the professional as well as the layman. Most often, concern is focused on physical changes associated with dumping, such as: degradation of recreational waters, sea bottom build-up, and toxicity to marine life. Yet many researchers have also studied effects that are not quite as obvious: heavy metal concentration in sediments, bacteria in shellfish, and polychlorinated biphenyl (PCB) accumulation. Rio de Janeiro, the major metropolitan area in Brazil, presently discharges almost 65% of its collected wastewater flow directly to the ocean via outfall. Plans are being made, however to treat this flow and of course, dispose of the resulting sludge. In evaluating possible sludge disposal methods, Brazilian engineers have not eliminated ocean disposal. By studying the experience and data developed for the ocean disposal operation used by Philadelphia, Brazilian engineers are evaluating the advantages and disadvantages of ocean use against other possible systems. The results are not yet in but preliminary indications show ocean disposal to be sound sludge management strategy. This report outlines the environmental impact aspects of such an evaluation. The data that have been assembled are largely a result of monitoring efforts carried out at Philadelphia's offshore disposal site by EPA. (Sinha OEIS)
W79-06663

TRANSIENT EFFECTS OF OCEAN WASTEWATER SLUDGE DUMPING,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
A. F. J. Draxler.
Journal Water Pollution Control Federation, Vol 51, No 4, p 741-748, April 1979. 5 fig, 18 ref.

Descriptors: *Waste water disposal, *Water pollution effects, *Environmental effects, Sludge disposal, New York, Nutrients, Settling velocity, *Outer Continental Shelf, New York Bight, Ocean dumping.

Wastewater sludge from the New York metropolitan area is barged to a site approximately 22-km equidistant between Long Island, New York and Sandy Hook, New Jersey where it is dumped in water 29-m deep. The sludge contains approximately 5% solids, which are 55% organic material, and has a large nutrient and heavy metal content. The spatial and seasonal distribution of nutrients in the water and metals in the sediment of the Bight and the distribution of ammonium nitrogen by waste dumping have both been previously investigated. In contrast to those studies, the purpose of these experiments was to investigate the dynamic processes that follow a single sludge dump: the settling of particulates, the dilution of nutrients, and the changes in oxygen concentration of the receiving water. (Sinha-OEIS)
W79-06664

EFFECTS OF OILFIELD BRINE EFFLUENT ON SEDIMENTS AND BENTHIC ORGANISMS IN TRINITY BAY, TEXAS,
Texas A and M University, College Station. Dept. of Biology.
H. W. Armstrong, K. Fucik, J. W. Anderson, and J. M. Neff.
Marine Environmental Research, Vol. 2, No. 1, p 55-69, January 1979. 3 fig, 2 tab, 34 ref.

Descriptors: *Sediments, *Benthos, *Brines, *Water pollution effects, *Environmental effects, Outfall sewers, Oil pollution, Texas, Resources development, *Outer Continental Shelf, Naphthalenes, Hydrocarbons, Petroleum development, Trinity Bay(TX).

Field studies have established the concentrations of naphthalenes in bay sediments and water in the vicinity of an oil separator platform and their effects on the benthic fauna. Fifteen stations were occupied monthly, from July, 1974 to December, 1975, along three transects extending from the separator platform outfall outwards for a distance of 4.0 to 5.6 km. A lesser number of stations were occupied from April, 1974 to June, 1974. Bottom sediments at each station were analysed for total haphthalenes content and for number of species and individuals. All stations were located in 2 to 3

of water. The outfall was located 1 m off the ay bottom. There was a definite correlation be- veen sediment naphthalenes concentrations and umber of species and individuals. The bay bottom as almost completely devoid of organisms within 5 m of the effluent outfall. Stations located 150 m om the outfall had severely depressed 455 m om the platform were unaffected. Trinity Bay, exas, the site of this investigation, has a mean epth of 2.5 m. The bay water is highly turbid due the presence of a high concentration of clay- zed particulate material. The brine outfall was cated approximately 1 m above the bay bottom. hese special conditions undoubtedly contributed gnificantly to the observed impact of the brine. herefore, extrapolations from the results of this udy to offshore oil production and brine disposal ould be made with extreme caution. (Sinha-EIS)
/79-06665

FFECTS OF PRUDHOE BAY CRUDE OIL ON RIMARY PRODUCTION AND ZOOPLANK- ON IN ARCTIC TRUNDRA THAW PONDS,
incinnati Univ., OH. Dept. of Biological Sci- nces.
. W. Federle, J. R. Vestal, G. R. Hater, and M. . Miller.
larine Environmental Research, Vol. 2, No. 1, p -18, January 1979. 8 fig, 2 tab, 17 ref.

Descriptors: *Oil pollution, *Zooplankton, *Phy- oplankton, *Primary productivity, *Water pollu- on effects, Alaska, Tundra, Environmental effect, Resources development, *Outer Continental Shelf, rudhoe Bay(AK), Petroleum development, Oil ransport.

The effects of Prudhoe Bay, Alaska, Crude oil on he indigenous phytoplankton and zooplankton of undra thaw ponds were studied under controlled onditions in sity during the summer of 1976. These effects were compared with uncontrolled oil pills on Pond Omega (a year previously) and Pond E (six years previously). In the uncontrolled pills, the phytoplankton species composition of oth ponds remained appreciably different com- ared with control Pond C, although phytoplank- on biomass did not differ greatly. Primary produc- ion remained low in Pond Omega but had recov- red to control levels in Pond E. In controlled ubpond experiments, oil caused a decrease of bout 90-100% in primary production in five days ut recovered to 40-50% of the control level vithin fifteen days. During that time, phytoplank- on biomass decreased initially but recovered vithin fifteen days. Oil caused a shift in phyto- lankton species composition from a predominance f cryptophytes to chrysophytes. Subponds con- aining two Daphnia middendorffiana and one Bra- hinecta paludosa per litre of pondwater were also ffected by oil, causing zooplankton death within hree or four days. After tht time, changes in the hytoplankton species composition were similar to control subponds without zooplankton. Oil toxicity o zooplankton or experimental removal resulted in loss of grazing pressure which caused the elimi- nation of the cryptophyte Rhodomonas sp. This pecies was still absent from Pond Omega, but was een in Pond E for the first time, when zooplank- on also re appeared after six years. Oil perturba- ion of tundra thaw ponds causes a loss of zoo- lankton and a reduction in primary production. Phytoplankton primary production recovers some- what but algal species composition remains hanged because of the loss of zooplankton grazing ressure and the selective effects of oil. (Sinha-OEIS)
W79-06666

OIL, FISHERIES, AND THE HEALTH OF THE ECOSYSTEM: A REVIEW,
National Marine Fisheries Service, Woods Hole, MA. Northeast Fisheries Center.
K. Sherman, and J. B. Pearce.
In: Marine Studies of San Pedro Bay, California. Part 15, p 240-258, December 1978. 3 tab, 33 ref.

Descriptors: *Oil pollution, *Water pollution ef- fects, *Oil spills, *Environmental effects, Fisheries, Ecosystems, Resources development, *Outer Continental Shelf, Petroleum hydrocarbons.

An overview of the effects of petroleum hydrocarbons in the marine environment on fisheries and on ecosystems is presented. Assessments of damage from major spills are reviewed. Each year 6 million metric tons of petroleum hydrocarbons enter the ocean. Of this amount 1% is attributable to offshore production, 44% is introduced from municipal and industrial wastes and river and urban runoff, 35% from transport and offloading operations, and 20% from natural seeps and atmospheric fallout. Measured against this total, an acute tanker spill represents a relatively small percentage of annual input. The Argo Merchant spill, while spectacular, represented 1% of the total annual input of oil in the marine environment. Oil is a complex mixture of hydrocarbons. Its toxicity to marine organisms is roughly proportional to its aromatic content. Greatest damage from a spill of petroleum hydrocarbons in a shallow nearshore environment results from the mixing of petroleum hydrocarbons in the water column, and subsequent penetration in the sediments. This action increases the residence time of the oil. (Sinha-OEIS)
W79-06667

FINAL REPORT ON THE BASELINE ENVIRONMENTAL SURVEY OF THE MAFLA LEASE AREAS.
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.
For primary bibliographic entry see Field 5B.
W79-06668

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, D. E. Smika, and D. F. Heermann.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. IR3, p 283-291, September 1978. 6 fig, 2 tab, 8 ref.

Descriptors: *Irrigation, *Groundwater, *Water quality, *Sprinklers, Aquifers, Nitrogen, Agriculture, Percolation, Water table, Water samples, Deep soil cores.

Nitrogen percolation beneath the crop root zone was significantly reduced by careful irrigation management using the USDA irrigation scheduling program. Deep percolation losses were measured directly using vacuum extractors. Analyses of both deep soil cores and water samples from piezometers suggest that significant amounts of percolating nitrate are removed by denitrification, either before or soon after reaching the water table, thus reducing the potential for groundwater contamination. (Bell-Graf--Cornell)
W79-06672

SURFICIAL SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W79-06690

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5A.
W79-06722

VARIATION IN THE CHEMICAL COMPOSITION OF FRESHWATER FISH,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
J. A. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 810, Price codes: A04 in paper copy, A01 in microfiche. Ph.D. Dissertation, Aquacultures, 1978, 58 p, 2 fig, 13 tab, 38 ref. OWRT A-066-ALA (1), 14-34-0001-8001.

Descriptors: Chemical composition, *Freshwater fish, Calcium, Magnesium, Sodium manganese, Phosphorus, Zinc, Copper, Ash, Oxygen, Lepomis macrochirus.

Three possible sources of variation in the chemical composition of freshwater fish were explored. These were (1) intersite variation of elements in fish and its relationship to the concentrations of the elements in the water from which they were taken, (2) intraspecific variation with respect to size of the fish, and (3) interspecific variation of chemical composition among species. Fish were collected from lentic waters representing widely varying water qualities to determine if concentrations of elements in water significantly affect their chemical composition. Statistical analyses indicated no significant relationships existed between Ca, Mg, Na, K, N, S, P, Zn and Cu concentrations in fish and the waters from which they were taken. This low correlation is probably due to homeostatic control of these elements by fish. Analyses of two size series of Lepomis macrochirus indicated positive correlations with length and concentrations of Ca, Na, P, Mn and ash. Negative correlations were shown for total-N, K, S and Zn concentrations and length. Eighteen species of freshwater fish were analyzed to determine variation among fish species. Ca, Mg, Na, Mn, P, Zn, Cu, ash and oxygen consumed demonstrated the greatest variation among species. Generally greatest variation was found among species and least variation was found among sizes.
W79-06732

ATTITUDES OF NEARBY RESIDENTS TOWARD ESTABLISHING SANITARY LANDFILLS,
Economics, Statistics, and Cooperative Services, Washington, DC.
D. T. Massey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 905, Price codes: A04 in paper copy, A01 in microfiche. Final Report No ESCS-03, 1974. 65 p, 33 tab, 4 append.

Descriptors: *Landfills, *Attitudes, *Land use, *Wastes, *Water pollution, *Water pollution sources, Waste disposal, Waste treatment, Environmental engineering, Environmental sanitation, Air pollution, Land development, Land reclamation, Effluents, Social values.

The attitudes of citizens in four survey areas concerning proposed or newly established landfills are analyzed in relation to factors that may influence those attitudes, and the major factors influencing the decision to oppose or favor a landfill's establishment are identified. Resident opposition to the establishment of sanitary landfills in nearby areas is largely due to the possibilities of water pollution, insects and rodents, odors, and blowing papers from the site. It is felt that these factors would be detrimental to property values. Public support of landfills was also discouraged by the use of land better suited for agriculture and heavy truck traffic on local roads. Most residents surveyed felt that landfills should be located at least 1 mile from residences and that landfills should be in operation less than 5 years. Promises concerning improved collection and disposal service, free access to the site, and development of the site as a future park or recreation area had little influence on those opposing or favoring the landfill. (Davison-IPA)
W79-06785

EVALUATION OF HYDROLOGIC MODELING TECHNIQUES FOR FOREST LAND MANAGEMENT PLANNING,
Washington State Dept. of Natural Resources, Olympia.
For primary bibliographic entry see Field 2E.
W79-06801

ENERGY ANALYSIS OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis.
R. J. Heggen, and K. J. Williamson.
Journal of the Water Pollution Control Federation, Vol. 51, No. 4, p 759-772, April 1979. 10 fig, 7 tab, 7 equ, 8 ref.

Descriptors: *Water pollution control, *Input-output analysis, *Methodology, *Energy, *Alternative planning, *Costs, Regional development, Effects, Dissolved oxygen, Rivers, Environmental control, Runoff, Flow augmentation, Cost allocation, Waste water treatment, Multiple-purpose reservoirs, Benefits, Evaluation, Mathematical models, Systems analysis, Equations, Willamette River(Oregon).

Two strategic approaches to water quality control in Oregon's Willamette River are presently being utilized: point source treatment and flow augmentation from reservoirs. Input-output analysis provides an econometric methodology to study direct and indirect response to pollution control alternatives. An energy input-output national model is coupled with a comprehensive Willamette River dissolved oxygen model. Alternatives of environmental control are evaluated as if they had been practiced in a study year of low natural runoff. The relation of augmentation for water quality to other river uses is used to value flow in a benefits-foregone manner. Independently, reservoir costs are allocated to water quality. For alternatives of treatment and augmentation, river quality, dollar cost and energy impact response surfaces are developed. Energy and dollar-efficient management call for the full role of augmentation in water quality control. (Bell Graf-Cornell)
W79-06802

OPERATORS PRESENT TESTIMONY IN DEFENSE OF PLAYA LAKE DISPOSAL,
J. Brewster.
Drill Bit, Vol. 28, No. 4, p 26-27, April, 1979.

Descriptors: *Playas, *Brine disposal, *Environmental effects, Waterfowl, Wading birds, Water pollution, Groundwater, Water pollution sources.

Key points underlying the controversy concerning environmental effects of brine disposal in playa lakes of west Texas are discussed. Disposal is confined to five lakes with a total area of over 7,000 acres. The number of bird kills due to oil and salt is disputable. The salinity of the lakes is higher than the brines due to rates of inflow and evaporation. The charge that brine disposal may contaminate ground water is unfounded since the aquifers in West Texas are situated above the playa lakes. Contamination would result only from heavy rains that would raise the level of the lake and reverse the flow of groundwater into the aquifer. (Purdin-NWWA)
W79-06808

BIOLOGICAL AND MICROBIOLOGICAL ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
B. W. Lium, J. K. Stamer, T. A. Ehlke, R. E. Faye, and R. N. Cherry.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202. Geological Survey Circular 796, 1979. 22 p, 22 fig, 5 tab, 16 ref.

Descriptors: *Algae, *Phytoplankton, *Nutrients, *Rivers, *Lakes, Eutrophication, Streamflow, Effluents, Waste water disposal, Dissolved oxygen, Low flow, Nitrification, Diatoms, Microorganisms, Georgia, *Upper Chattahoochee River basin, *West Point Lake(Ga).

Biological and microbiological studies were conducted by the U.S. Geological Survey as a part of the Intensive River-Quality Assessment studies of the upper Chattahoochee River basin, Georgia. Phytoplankton concentrations in cells per milliliter (cells/mL) were generally higher downstream from Atlanta than upstream. The highest concentrations, mostly blue-green algae, occurred in West Point Lake with an average of 90,000 cells/mL for the sampling period. The lowest concentrations, 1,000 cells/mL, occurred upstream of Lake Sidney Lanier. Dissolved orthophosphate and nitrite plus nitrate concentrations were highest in the river reaches and upper reaches of the two lakes and were lowest at the dam pools of both lakes. The high nitrite plus nitrate concentrations downstream from Atlanta were primarily a result of nitrification by Nitrosomonas and Nitrobacter bacteria. Algal growth potential was highest downstream from Atlanta, 25 milligrams per liter (mg/L) at Whitesburg, and was the lowest in the headwaters and at the dam pools of Lake Sidney Lanier and West Point Lake. The rate of nitrification in the Atlanta to Franklin reach of the river was comparatively low, 0.02 mg/L per hour. Nitrification was an important cause of dissolved-oxygen consumption in a 45-mi reach of the river downstream from the Atlanta wastewater treatment facilities. Dissolved-oxygen consumption as a result of nitrification may be greatest during low flow. (Woodard-USGS)
W79-06819

IMPACT OF COPPER MINING ON A DESERT INTERMITTENT STREAM IN CENTRAL ARIZONA: A SUMMARY,
Arizona State Univ., Tempe. Dept. of Zoology.
M. A. Lewis, and R. Burraychak.
Journal of the Arizona-Nevada Academy of Science, Vol. 14, No. 1, p 22-29, Feb. 1979, 3 fig, 2 tab, 33 ref.

Descriptors: *Mine water, *Mine wastes, *Environmental effects, *Aquatic habitats, *Pollutant identification, Sedimentation, Primary productivity, Mining, Water quality, Ephemeral streams, Water chemistry, Aquatic environments, Fish populations, Suspended solids, Hydrobiology, Microbial degradation, Biota, Water pollution, Heavy metals, Arizona, Diel migration.

The present report summarizes the results of a 2 year study conducted at the Pinto Valley Mine at Pinto Creek in the Tonto National Forest, Gila County, Arizona, to determine the detrimental impact of a large mine on biotic survival in a small desert stream. Water chemistry of Pinto Creek was monitored bi-weekly during 1975-1976 at 4 stations, one above and three below the discharge points, by Tonto National Forest service personnel following standard procedure. Primary production for 2 stream areas was estimated from analysis of diel changes in dissolved oxygen. Surveys of fish, aquatic macroinvertebrates, and vegetation were conducted during 1975-1976 at 13 sampling stations along the total length of the stream. Results clearly indicated the hazards of mining to the stream biota with sedimentation having the primary detrimental effect by elimination of much of the biota, reduction of primary production, and alteration of normal habitat. Unlike suspended solids, however, heavy metals entering the stream were found to be sufficiently diluted to non-toxic levels. Although the quantity and quality of the biota were not as yet noticeably affected 10 km downstream from the discharge channels, sediment encroachment is expected to cause a reduction in primary production both as a direct source of food and as a primary source of energy. (Tickes-Arizona)
W79-06840

FISH TOXICITY EVALUATION OF EFFLUENTS FROM AN ORGANIC CHEMICAL PRODUCTION COMPLEX, BASF, GERMANY,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
V. W. Cairns, K. Conn, B. E. Jank, and U. Pagga.
Technology Development Report EPS 4-WP-79-3, February 1979, 58 p, 10 fig, 9 tab, 4 app.

Descriptors: *Fish, *Toxicity, *Effluents, *Organic wastes, *Chemical wastes, Waste water treatment, Chemical analysis, Pollutants, Temperature.

BASF Aktiengesellschaft of the Federal Republic of Germany and the Environmental Protection Service, Canada cooperated in a study to assess the toxicity reduction capability of the wastewater treatment system for the BASF plant at Ludwigshafen, Federal Republic of West Germany. Information obtained was to be used for assessment of best practicable technology for the Canadian organic chemical industry as part of Environment Canada's program of developing regulations and guidelines governing discharge of pollutants. A preliminary program, Phase 1, carried out by BASF, determined that no change in acute toxicity or chemical composition occurred in wastewaters subjected to 48-hour, non-refrigerated storage. For Phase 2 of the operation, eight-hour composite samples of raw wastewater, primary settled effluent and activated sludge plant effluent were collected by BASF personnel and shipped by air to the Wastewater Technology Centre, Burlington, Ontario for toxicity testing. A total of 18 samples were shipped over a period of four weeks. Bioassays and chemical analyses were carried out on the samples both as received and after removal of ammonia using clinoptilolite. All samples exhibited lethality to rainbow trout and although ammonia removal was not complete in all cases, results suggested that a significant portion of the toxicity in the samples could not be attributed to ammonia. After comparing analytical data with long term performance data, it was concluded that bioassay results are representative of what could be expected during long term operation of the treatment system. (WATDOC)
W79-06848

EFFECT OF UPGRADING A MUNICIPAL WASTEWATER EFFLUENT ON POLLUTION INDICATOR AND OTHER MICROORGANISMS IN RIVER WATER,
Connecticut Univ., Noank. Marine Research Lab.
For primary bibliographic entry see Field 5B.
W79-06856

FURTHER STUDIES ON THE EFFECTS OF STRESS IN THE ADULT ON THE EGGS OF MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
B. L. Bayne, D. L. Holland, M. N. Moore, D. M. Lowe, and J. Widdows.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 4, p 825-841, 1978, 3 fig, 10 tab, 2 plates, 26 ref.

Descriptors: *Environmental effects, *Stress, Thermal stress, Temperature, Salinity, Food abundance, Mussels, Reproduction, Animal physiology.

Groups of mussels were exposed to varying temperature, salinity and food conditions. Measurements of the energy status of individuals was used to assess the physiological condition of adults. As a result of stress to adults, resorption of some ripe gametes occurred as well as lysosomal destabilization in the both the digestive cells and the Leydig cells. Mussels under stress produced fewer and smaller eggs, in smaller follicles, than those not under stress. Eggs from stressed females contained less lipid and protein than eggs from unstressed females. The importance of these physiological relationships in understanding environmental impact on ecological fitness is pointed out. (Chilton-ORNL)
W79-06857

BIOLOGICAL TREATMENT, EFFLUENT REUSE, AND SLUDGE HANDLING FOR THE SIDE LEATHER TANNING INDUSTRY,
Polkowski, Boyle and Associates, Madison, WI.
For primary bibliographic entry see Field 5D.
W79-06865

THIRD ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS (NO. 1293-2246),
Environmental Research Lab., Narragansett, RI.
R. Eisler, D. J. O'Neill, Jr., and G. W. Thompson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 953, Price codes: A21 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-005, January 1978. 493 p.

Descriptors: *Bibliographies, *Publications, *Environmental effects, *Aquatic environment, *Metals, Toxicity, Behavior, Animal growth, Plant growth, Reproduction, Retention, Salt balance, Documentation.

A total of 954 journal articles and laboratory and field investigation reports are listed on toxicological, physiological and metabolic effects of stable and radioactive species of heavy metals and other cations to aquatic life. Each reference is annotated and indexed by metal, by taxon and by author. Most references listed were published between 1971 and 1976, but a large minority, in print for sometime, have only recently become available. The selected articles emphasize the following response parameters: survival; growth; reproduction; behavior; bioaccumulation; retention; translocation; histopathology; baseline data on elemental composition; changes in exogenous salt content on responses including internal changes in salt balance of body fluids and tissues; interaction effects of metals and their salts in combination with other substances; and modifying effects of biotic and abiotic factors on all parameters examined. Three cumulative indices encompassing this volume and two preceding volumes are presented: Index-Metals, Index-Taxa, and Index-Authors. (Davison-IPA)
W79-06866

TEMPERATURE EFFECTS ON THE INCORPORATION OF SIALIC ACID INTO GANGLIOSIDES AND GLYCOPROTEINS OF FISH BRAIN,
Stuttgart Univ. (Germany, F.R.). Zoologisches Inst.
H. Rosner, H. Breer, R. Hilbig, and H. Rahmann.
Journal of Thermal Biology, Vol. 4, p 69-73, 1979, 2 fig, 1 tab, 27 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Physiology, Seasonal, Central nervous system.

The influence of temperature changes on the incorporation of sialic acid into brain gangliosides and sialoglycoproteins in fish was investigated following intracranial injections of the specific precursor N-(H3) acetylmannosamine. The data show that radioactive in vivo labelling of brain gangliosides and sialoglycoproteins by application of N-(H3) acetylmannosamine is much more temperature-sensitive than the radioactive labelling of brain proteins by means of (H3) leucine. Brain gangliosides were labelled 4-5 times more heavily at 20 C as compared to 7 C, whereas sialoglycoproteins are labelled only 2-3 times as much. Renewal of gangliosides in the nerve endings of the optic tract was negligible at 7 C. It was concluded that at lower environmental temperatures the turnover of multisialogangliosides is diminished to a larger extent than that of oligosialogangliosides. These differentiated temperature effects may be the reason for seasonal changes in the brain ganglioside pattern observed in goldfish, carp and rainbow trout. (Chilton-ORNL)
W79-06875

COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA: A UNIQUE RIPARIAN ECOSYSTEM,
Mankato State Univ., MN. Dept. of Biology.
For primary bibliographic entry see Field 4A.
W79-06876

PROCEEDINGS: LAKE MANAGEMENT CONFERENCE, JUNE 9, 1977, UNIVERSITY OF CONNECTICUT, STORRS.
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 2H.
W79-06893

THE HEALTH EFFECTS OF GROUND WATER RECHARGE. PART I,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 4, p 34-35, April, 1979.

Descriptors: *Artificial recharge, *Waste water pollution, *Water reuse, Groundwater, Water quality, Pollutants, Bacteria, Viruses, Inorganic compounds, Organic compounds, Trace elements, Toxicity, Recycling.

The potential health effects resulting from the use of surplus wastewater for artificial ground water recharge are discussed. The quality and chemical composition of such wastewater and excess surface runoff must be carefully examined and controlled to avoid long-term contamination of aquifers. Contaminating agents are either biological or chemical. Giardiasis is a common bacteria found in contaminated drinking water which causes an intestinal disease. Viruses, such as hepatitis are extremely difficult to monitor but have been clearly traced to sewage-contaminated water. Arsenic and Barium are two potentially toxic inorganic compounds found in water. Unlike inorganic chemicals, the presence of even trace amounts of organic chemicals in treated, reclaimed water is of great concern. The long-term effects of low doses of potentially toxic compound in water is not known. (See also W79-06896) (Purdin-NWWA)
W79-06895

WATERBORNE DISEASE - A STATUS REPORT EMPHASIZING OUTBREAKS IN GROUND WATER SYSTEMS,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W79-06909

WATERBORNE DISEASE - CURRENT THREAT,
California Univ., Berkeley. School of Public Health.
R. C. Cooper.
Ground Water, Vol. 17, No. 2, p 192-196, March-April, 1979. 2 tab, 24 ref.

Descriptors: *Water quality, *Diseases, *Water treatment, Organic compounds, Trace elements, Hardness(Water), Asbestos, Water sources, Potable water, Groundwater.

Modern water treatment technology can reduce the number of known pathogens to acceptable levels. Certainty of such control depends upon treatment plant reliability and integrity of water distribution lines. Water supplies that meet bacterial standards may still transmit viruses. Soft water has been associated with a higher incidence of cardiovascular disease, infant mortality, and spina bifida. Asbestos has been suspected as a possible contributor to the incidence of cancer. The public health implications of the presence of trace amounts of organic compounds in water is uncertain due to the chronic nature of diseases suspected to be associated with these chemicals and the uncertainty involved in extrapolating data from test animal receiving high doses of suspect compounds. Epidemiological evidence is accumulating that indicates correlations between trihalomethanes (including chloroform) in drinking water and cancer morbidity (mortality). Recently the U.S.E.P.A. has put forth a target level of 100 mg/l for THM in drinking water. Correlations between water source and cancer have also been shown. Cancer rates are frequently higher in areas that obtain drinking water from surface streams than in areas that use ground water. (Purdin-NWWA)
W79-06910

WATERBORNE DISEASE - HISTORICAL LESSON,
Illinois Environmental Protection Agency, Springfield. Div. of Public Water Supplies.
I. M. Markwood.
Ground Water, Vol. 17, No. 2, p 197-198, March-April, 1979.

Descriptors: *Waterborne diseases, *Water supply, Disinfection, Water treatment, Microorganisms.

With modern technology and proper precaution epidemics of typhoid, cholera and other waterborne diseases are no longer a threat. All waterborne outbreaks in public water supplies in this country since World War II have been caused by breakdowns in disinfection procedures or carelessness. If the lessons of history were followed exactly, water borne disease transmission by public water systems would no longer occur. (Purdin-NWWA)
W79-06911

ECOLOGICAL EFFECTS OF URBAN STORMWATER RUNOFF ON BENTHIC MACROINVERTEBRATES INHABITING THE GREEN RIVER, MASSACHUSETTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
J. M. Pratt, and R. A. Coler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 315, Price codes: A05 in paper copy, A01 in microfiche. University of Massachusetts Water Resources Research Center Publication No. 100, 1979. 75 p, 6 fig, 14 tab, 46 ref. OWRT-A-094-MASS (1), 14-34-0001-7046.

Descriptors: Aquatic animals, *Aquatic insects, *Bioindicators, *Environmental effects, Biological communities, Impaired water quality, Invertebrates, Massachusetts, Rivers, Runoff, *Urban runoff, *Water pollution effects, Indicator organisms, Green River.

Although it has been demonstrated that urban stormwater runoff can alter the quality of receiving waters, the corresponding impact on aquatic biota remains essentially undocumented. A year-long intensive study, therefore, was implemented to monitor and describe ecological effects exerted by urban runoff on benthic macroinvertebrates, and to develop practical methodologies for biological monitoring. Rock-filled, basket-type artificial substrates deployed periodically in nonurban and urban river reaches yielded collections of macroinvertebrates that furnished data for: (1) species diversity (the Brillouin index, H), (2) hierarchical diversity, (3) major-taxa composition, (4) collection dissimiliarity at the species level, and (5) indicator species. The overall results from these five analytical procedures strongly indicate that the macrobenthic community became progressively disrupted downstream in the urban reach. The stress imposed by urban runoff was most acute during the summer low flow and was probably localized in or near the stream bed. To assess the impact of urban runoff on an aquatic ecosystem, physical, chemical, and biological monitoring, therefore, should extend routinely into the benthos. (Godfrey-Mass)
W79-06917

HEALTH EFFECTS OF HUMAN EXPOSURE TO BARIUM IN DRINKING WATER,
Illinois Univ. at the Medical Center, Chicago.
G. R. Brenniman, W. H. Kojola, P. S. Levy, B. W. Carnow, and T. Namekata.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 268, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-79-003, January 1979. 140 p, 4 fig, 81 tab, 71 ref, 4 append. R803918.

Descriptors: *Potable water, *Barium, *Public health, *Human pathology, Water pollution effects, Toxicity, Water analysis, Human diseases, Mortality, Morbidity, Epidemiology, West Dundee, McHenry(Illinois).

An investigation was undertaken to determine if health effects could be identified in a population exposed to barium in its drinking water. An analysis of death rates for communities exposed to barium concentrations of 2 mg/l or greater and

those with no significant exposure showed higher death rates for all 'cardiovascular diseases' and 'heart diseases' in barium exposed communities. A morbidity study was conducted in West Dundee and Mc Henry, Illinois, to determine if differences exist in mean blood pressure levels and the presence of hypertension, cardiovascular, cerebro-vascular and renal disease between the two populations. West Dundee's drinking water had a barium concentration 70 times that of the Mc Henry drinking water. Some significant differences were found for mean age and sex-adjusted levels of systolic blood pressures between the two communities, but these data were inconclusive due to inconsistencies in the findings. No significant differences were found between the communities regarding the prevalence of hypertension, heart disease, stroke, or kidney disease. No definite conclusion was drawn to permit the recommendation of a safe standard for barium in drinking water. (Davison-IPA)
W79-06944

HUMAN HEALTH EFFECTS OF MOLYBDENUM IN DRINKING WATER,
Colorado Univ., Boulder. Environmental Trace Substances Research Program.
W. R. Chappell, R. R. Meglen, R. Moure-Eraso, C. C. Solomons, and T. A. Tsongas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 755, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-79-006, January 1979. 113 p, 19 fig, 23 tab, 187 ref, 3 append. R-803645.

Descriptors: *Potable water, *Molybdenum, *Public health, *Human pathology, Water analysis, Chemical analysis, Biochemistry, Animal physiology, Metabolism, Nutrient requirements, Waste water treatment, Water treatment, Water quality standards.

An assessment of the present environmental exposure to molybdenum and the health effects of such an exposure are presented. Molybdenum (MO), a trace element widely occurring in nature, plays an important biological role as a micronutrient for plants and animals. It can be toxic to animals at high levels. Concentration in surface waters is generally less than 5 micrograms/L, concentrations as high as 500 micrograms/L has been reported in some drinking waters. Greater concentrations than 20 micrograms/L are thought to be the result of industrial contamination. Conventional waste water and water treatment technoligies remove only 14% of molybdenum. In the U.S. average human intake via food is 170 micorgrams Mo/day; the average intake via drinking water is less than 5 micrograms Mo/day. No adverse health effects have been reported in the U.S., but Russian and Indian literature report cases of biochemical and clinical effects in humans at intakes ranging from 1 to 10 mg Mo/day. Data on molybdenum relating to the effects of its occurrence in drinking water are reviewed. An interdisciplinary study is also reviewed. Although a drinking water standard for molybdenum is not required, a maximum of 50 micrograms Mo/L is recommended as a guideline. (Davison-IPA)
W79-06945

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5D.
W79-06950

SOME BIOCHEMICAL AND PHYSIOLOGICAL ASPECTS OF GROWTH AND GAMETOGENESIS IN CRASSOSTREA GIGAS AND OSTREA EDULIS GROWN AT SUSTAINED ELEVATED TEMPERATURES,
Woods Hole Oceanographic Institution, MA.
R. Mann.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, No. 1, p 95-110, 1979, 5 fig, 2 tab, 38 ref.

Descriptors: *Environmental effects, Temperature, Oysters, Reproduction, Spawning, Biochemistry, Animal physiology, Growth rates.

Two species of oysters (Crassotrea gigas and Ostrea edulis) were grown at sustained temperatures of 12, 15, 18, and 21 C for 19 weeks. Absolute live weight increment over the experimental period was greater in C. gigas than in O. edulis. Terminal live weights increased with increasing temperature in both species. Final dry meat weight was not related to temperature in C. gigas but was positively related to increasing experimental temperature in O. edulis. Both species showed an initial increase in percentage carbohydrate at all temperatures which was followed by a decrease in carbohydrate content in C. gigas. Evidence of hermaphroditism was found in 27% of O. edulis examined while none was found in C. gigas. Ripe gonads developed in both species at all temperatures but C. gigas spawned only at 18 and 21 C while O. edulis spawned at 15, 18, and 21 C. In the pre-spawning period, ammonia excretion data showed an allometric relationship with weight in both species. Post-spawning data showed a higher specific excretion rate for any given dry meat weight. Post-spawning data points do not fit any simple relationship that can be described by linear regression analysis. (Chilton-ORNL)
W79-06958

BRAIN GANGLIOSIDES AND TEMPERATURE ADAPTATION IN EURY- AND STENOTHERMIC TELEOST FISH (CARP AND RAINBOW TROUT),
Stuttgart Univ. (Germany, F.R.). Zoologisches Inst.
R. Hilbig, H. Rahmann, and H. Rosner.
Journal of Thermal Biology, Vol. 4, p 29-34, 1979, 6 fig, 32 ref.

Descriptors: *Environmental effects, *Temperature, Seasonal, Fish, Carp, Rainbow trout, Physiology, Temperature adaptation, Acclimation, Fish brain, Nervous system.

Data showed significant changes in the brain ganglioside pattern of carp and rainbow trout during thermal adaptation to lowered environmental temperatures. During adaptation to experimentally induced acclimation as well as to seasonal temperature fluctuations, distinct changes in the brain gangliosides to a more polar pattern could be detected. In carp, this polysialization phenomenon was due to a decrease of almost all oligosialoganglioside in favor of polar fractions. In trout brains a more differentiated pattern change occurred, which was characterized by a conspicuous decrease in the concentration of the hematosideganglioside. Further investigation into these physico-chemical properties of brain gangliosides and ganglioside-containing membrane preparations of animals from different temperature biotopes is needed. (Chilton-ORNL)
W79-06983

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
For primary bibliographic entry see Field 7B.
W79-07000

5D. Waste Treatment Processes

CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES; TASK IV - ACTIVATED CARBON,
Midwest Research Inst., Kansas City, MO.
G. L. Kelso, and T. W. Lapp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 181, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-560/2-77-002. 1977. 28 p, 5 tab, 21 ref.

Descriptors: *Activated carbon, *Specifications, *Standards, Heavy metals, Food processing industry, Waste water treatment, Water treatment, Organic compounds, Economics.

Information on various aspects of the manufacture and use of activated carbon was compiled. Market input-output data was determined including manufacturers, manufacturing sites, raw materials, production volumes, grades of product, and use patterns. Product quality specifications were determined with respect to the presence of heavy metal ions and/or polynuclear aromatic hydrocarbons in the commercial product. If impurities were present, procedures for their removal were determined. US annual capacity is 305 million lb of which about one half is granular. Of the 180 lb consumed in the US in 1975, 37% was used in the food processing and pharmaceutical industries, 25% in water or waste treatment processes, and 38% in other applications. The Food Chemicals Codex and specific consumer specifications are employed for heavy metal and polynuclear hydrocarbon content. Due to temperatures of about 1000C reached during the steam activation process, little, if any, quantities of PAH remain in activated carbon. (Small-FIRL)
W79-06507

WATER HYACINTHS FOR UPGRADING SEWAGE LAGOONS TO MEET ADVANCED WASTEWATER TREATMENT STANDARDS: PART II,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-16481, Price codes: A02 in paper copy, A01 in microfiche. Report TM-X-72730, 1976. 22 p, 10 fig, 2 tab, 8 ref.

Descriptors: *Waste water treatment, *Water hyacinth, *Sewage lagoons, Filtration, Standards, *Efficiency, Waterfowl, Biological oxygen demand, Suspended solids.

Field studies on the use of water hyacinths (Eichhornia crassipes) as an inexpensive, natural biological waste filtration system for upgrading sewage lagoons, are reviewed. A single cell lagoon containing four or five surface hectares covered with water hyacinths with a retention time of at least 12 days, met the sewage effluent standards of Bay St. Louis. Over a four month period, the BOD dropped from 22 mg/liter to an average of 16 mg/liter and total suspended solids were reduced by 88% in the effluent from a background level of 125 mg/liter to 15 mg/liter. Water hyacinths were also a successful sewage treatment process for the Orange Grove lagoon. Coots were found to feed on the water hyacinths and could greatly decrease the efficiency of the system. Thus, it is necessary to protect the hyacinths from birds. (See also W77-00621) (Small-FIRL)
W79-06508

DISINFECTION EFFICIENCY AND RESIDUAL TOXICITY OF SEVERAL WASTEWATER DISINFECTANTS. VOLUME II. WYOMING, MICHIGAN,
Grand Valley State Colleges, Allendale, MI.
R. W. Ward, R. D. Giffin, and G. M. DeGraeve.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 448, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-203, 1977. 105 p, 21 fig, 38 tab, 33 ref.

Descriptors: *Waste water treatment, *Toxicity, *Chlorine, *Ozone, *Performance, Bromine, Municipal wastes, Disinfection, Fish, Minnows, Bioassay.

The effectiveness of chlorine, bromine chloride, and ozone as waste water disinfectants was compared, and the residual toxicity associated with disinfection by these methods or with chlorinated waste water which was dechlorinated with sulfur dioxide, was investigated. Nondisinfected trickling filter effluent from the Wyoming, Michigan Wastewater Treatment Plan was used in the tests. Three streams of the effluent were disinfected with

her chlorine, bromine chloride, or ozone and en delivered to the bioassay laboratory for resid- l toxicity tests. A fourth stream was delivered rectly to the bioassay laboratory for testing. lso, a portion of the chlorinated effluent was chlorinated with sulfur dioxide and then pumped the bioassay laboratory. Measurements were ade of: total and fecal coliform densities, total spended solids, volatile solids, COD, ammonia trogen, phosphate, turbidity, color, and pH. lso, each of the five waste water streams was sted for acute toxicity towards several species of h and invertebrates and chronic toxicity in a life rcle study with the fathead minnow (Pimephales omelas). Ozone was nontoxic to fish in concen- ations in waters after disinfection, sulfur dioxide minated the toxicity of chlorine, and bromine loride was less toxic than chlorine. Lack of a liable method for pacing ozone dosages impaired e disinfection effectiveness of ozone. (See also 77-11762) (Small-FIRL)
79-06509

FFECT OF GEOGRAPHY ON THE EXTEN- IVE AGRICULTURAL USE OF SEWAGE,
rmy Terrestrial Sciences Center, Hanover, NH.
Wierzbicki.
vailable from the National Technical Information ervice, Springfield, VA 22161 as AD-A044 765, rice codes: A02 in paper copy, A01 in microfiche. raft Translation 642, 1977. 6 p, 2 tab. Translated om Gaz Woda Technika Santarna, Vol. 24, No. , p 407-410. 1950.

escriptors: *Waste water treatment, *Municipal astes, *Agriculture, Soils, Climates, *Europe, rrigation, Waste water disposal, Toxicity, Return ow.

Vaste water treatment through application of the ater to agricultural lands is limited by various soil nd climatic conditions. This method has been rgely abandoned in England because of the gen- ally heavy soil and the long growing season. lso, due to heavy industrialization, English mu- icipal waste water often contains chemicals which re harmful or toxic to plants. In Central Europe, ne conditions are favorable for waste water irriga- on. There is an insufficient amount of precipita- on during the growing season, the soil is general- y permeable, there is an abundance of light, and ne waste water is generally suitable for agricultur- l use. This method is common in Poland. (Small- IRL)
V79-06534

AIR POLLUTION ASPECTS OF SLUDGE IN- CINERATION.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 457, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-625/4-75-009, 1975. 16 p, 4 fig, 6 tab, 2 ref.

Descriptors: *Incineration, *Sludge disposal, *Air pollution, *Municipal wastes, Clean Air Act, Opacity, Mercury, Sulfur compounds, Pesticides.

Incineration reduces sludge to a sterile landfill and removes offensive odors, but it can cause air pollu- ion problems. Existing, well-designed municipal waste water sludge incinerators are capable of meeting stringent standards. When particulate emission was studied, no relationship was found between mass emission rates of particulates and the percent of rated capacity at which the incinerator was operating, but a strong relationship was found between pressure drop across the scrubber and mass emission rates. The cost of the scrubbing systems was usually about 4% of the cost for the facility, and all plants tested easily met the opacity standard. No known existing plants approach the national emission standard for Hg. Possible gaseous pollutants include HCl, SO2, NOX, and CO. Again, properly operated incinerators did not exceed the limits for these pollutants. For some pesticides containing sludges, afterburners may be needed to achieve total destruction of the pesticides. (Small-FIRL)
W79-06540

CHARACTERIZATION OF PRIORITY POL- LUTANTS FROM A SECONDARY LEAD AND BATTERY MANUFACTURING FACILITY,
Battelle's Columbus Lab., Columbus, OH.
E. J. Mezey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 171, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-79-039, January 1979. 41 p, 2 fig, 10 tab, 1 ref, 1 append.

Descriptors: *Metals, *Lime, *Flocculation, *Settling basins, *Slurries, Copper, Zinc, Lead, Cadmium, Mercury, Chromium, Nickel, Waste water treatment, Industrial wastes.

An evaluation of a lime and settling treatment of effluent from a manufacturing plant producing secondary lead from old batteries was conducted according to EPA protocol procedures for priority pollutants. The treatment process mixes 3,738 lbs dry lime/day with 410,500 gpd of influent waste water. The slurry is then fed to a second reaction tank where it is treated with a flocculating agent at a rate of 3.8 liters/min to promote flocculation and crystal growth. The waste water then undergoes clarification and settling before discharge to a receiving stream. Underflow is thickened to 5% solids and landfilled. The treatment process reduced copper by 75.0%, zinc by 91.0%, lead by 95.0%, cadmium by 73.0%, and mercury by 100.0%. Benzene and cyanide concentrations were reduced to below their detection limits; phenols were below detection limits in both influent and effluent. The removal of antimony, chromium, and nickel from the waste water could not be evaluated with any degree of confidence because of extremely low concentrations of these metals. (Lisk-FIRL)
W79-06541

DEVELOPMENT AND PRESENT CONDITION OF SEWAGE TREATMENT AND UTILIZA- TION IN BERLIN,
Army Terrestrial Sciences Center, Hanover, NH.
K. Weiland.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 780, Price codes: A11 in paper copy, A01 in microfiche. Draft Translation 655, 1977. 17 p, 5 fig. Translated from Wasserwirtschaft-Wassertechnik Vol. 7, p 229-235, July 1955.

Descriptors: *Municipal wastes, *Europe, *Agriculture, *Waste water treatment, *Sewage treatment, Sewerage, Settling basins, Performance, Irrigation, Return flow.

The development and utilization of the sewage treatment system of the city of Berlin, Germany as of 1955, are reviewed. Berlin's sewage treatment system began in 1878 when its first sewer system began operation. Sewage was processed on agricultural lands. In 1928, the Municipal Drainage System utilized 23,036 hectares excluding woodlands. Of these, 10,708 hectares were used for drainage and the remaining areas were channel, water, and gardening surfaces. In 1953, 17,900 hectares were in use. In 1955, there were 654 settling basins in operation. The settling cycle for the basins ranged from one to one and one half hours, and the degree of purification was 70 to 95%. The design of several drainage areas is described. (Small-FIRL)
W79-06546

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICI- PAL WASTEWATER.
SCS Engineers, Long Beach, CA.
For primary bibliographic entry see Field 5C.
W79-06567

WATER QUALITY MANAGEMENT GUIDE FOR MINE-RELATED POLLUTION SOURCES (NEW, CURRENT AND ABANDONED),
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
D. Deely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 625, Price codes: A10 in paper copy, A01 in microfiche. Report No EPA-440/3-77-027, December 1977. 198 p, 16 fig, 6 tab, 88 ref, 2 append.

Descriptors: *Mine drainage, *Water quality control, *Management, *Planning, Water pollution sources, Water Pollution Control Act Amendments of 1972, Mine wastes, Surface runoff, Erosion control, Water pollution control, Pollution abatement, Mine acids, Mine water, Programs.

Suggested work plan tasks and task sequences are offered as guidance to State and areawide water quality management (WQM) agencies dealing with mine-related sources of pollution as directed under Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977. The aspects of the mine-related water quality management plan, discussed and explained separately, include: (1) identification and assessment of existing current and abandoned sources; (2) current source control; (3) identification and use of best management practices; (4) abandoned source abatement; (5) new source planning; and (6) continuing management and WQM planning. The mining regulatory control system features needed for effective water pollution prevention and control, basic mining water pollution control principles, and distinctions between point sources and nonpoint sources are discussed. (Davison-IPA)
W79-06568

STUDY AND ANALYSIS OF THE APPLICA- TION OF SALINE WATER CONVERSION PROCESSES TO ACID MINE WATERS,
Maryland Univ., College Park. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 3A.
W79-06574

STUDY ON THE EFFECTIVENESS OF DISIN- FECTING SEWAGE CONTAINING TUBERCU- LOSIS BACILLI WITHOUT BIOLOGICAL TREATMENT,
W. Dozanska, and W. Manowska.
Available from the National Technical Information Service, Sringfield, VA 22161, as ORNL-tr-4364, Price codes: A 02 in paper copy, A01 in microfiche. Translatd from Panstwowy, Zaklad nigreny. Roczinki. Translation 1977. 12p, 4 tab, 19 ref. Warsaw Vol 23, No 3, 1972.

Descriptors: *Disinfection, *Chlorination, *Sewage treatment, Sewage bacteria, *Bacteria, Waste treatment.

The possibility of effective disinfection of sewage containing tuberculosis bacilli by means of mechanical purification without biological treatment was investigated. Laboratory tests were performed on the influence of various suspensions upon destruction of bacilli in an aqueous environment using chlorine. Mechanical treatment and disinfection by chlorine were effective. When residual chlorine levels were 5 mg/liter Cl after 60 min, destruction of the tubercle bacilli approached 100%. Using this method, chlorine demand was 1.8 times greater than after biological purification. Virulent strains of tubercle bacillus were detected in sewage using various biological methods and guinea pigs. (Small-FIRL)
W79-06584

PAPERMILL EFFLUENT TURBIDITY RE- MOVAL -- A NEW APPROACH,
J. Delaine.
Effluent and Water Treatment Journal, Vol. 18, No. 5, p 219-221, 223, May, 1978. 2 fig, 4 ref, 3 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Turbidity, Wastes, Industrial wastes, Waste

treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Sedimentation, Separation techniques, Flocculation, Sludge, Enzymes, Clays, Electrolytes, Polyelectrolytes, Lime, Sea water, Aluminum sulfate, Manganese sulfate.

Rising water treatment and effluent treatment costs have directed considerable attention to the closure of water systems within the paper industry. Coupled with the increasing use of secondary fibers in paper mills, this often leads to new problems in effluent treatment, particularly higher concentrations of starch-stabilized fines in the effluent. Clarification of such effluents by conventional means may be difficult. New and modified effluent sedimentation procedures are evaluated, namely, the sludge contact process in which preformed flocs of sludge are mixed with the incoming chemical-dosed feed, enzyme-assisted aluminum sulfate flocculation (e.g., alpha-amylase), replacement of aluminum sulfate by a bentonite/high-molecular weight polyelectrolyte system for flocculation, and the addition of hydrated manganese sulfate directly or indirectly (i.e., contained in sea water) during lime treatment. (Swichtenberg-IPC)
W79-06620

METHOD FOR THE TREATMENT OF SEA DISCHARGED SEWAGE,
Hydrotechnic Corp., NY. (Assignee).
R. Nebolsine.
U.S. Patent No. 4,128,477, 7 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 1, p 201, December 5, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Waste water disposal, Sewage effluents, Filtration, Coagulation, Oxidation, Separation techniques, Ocean disposal, Outfalls.

A method is disclosed for treating sewage destined for discharge into the sea. The fluid treatment process comprises conducting the sewage through bar racks, and degritters to remove large scale particles, extracting intermediate size particulate material in a rotary drum screen, introducing a chemical composition into the fluid to promote coagulation of particles having an average particle size of less than about 1 micron, filtering the fluid containing the coagulated particles through a deep bed multi-media filter, adjusting the quantity of dissolved oxygen in the filtrate to a predetermined level and discharging the oxygenated fluid to the sea some distance offshore to permit dispersal of any remaining contaminants by action of wind and currents. (Sinha-OEIS)
W79-06623

OZONE DISINFECTION IN WASTE WATER TREATMENT WITH RECYCLING OF OZONATION OFF GAS,
FMC Corp., Chicago, IL. (Assignee).
W. P. Key, D. C. Ihrig, and D. W. Monroe.
U.S. Patent No. 4,132,637, 22 p, 11 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 233-234, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Disinfection, Activated sludge, Ozone, Gases, Equipment.

A method of recycling the off gas from an ozone disinfection step used with an activated sludge waste water treatment system and apparatus for carrying out the method is described. In recent years the treatment of the effluent of effluent of sewage treatment plants - in the form of air or oxygen containing a few percent of ozone - has been widely used as an alternative to chlorination. Ozonation of sewage treatment plant effluent has been found to be very effective for disinfection of the effluent. The moisture is removed from a substantial portion but not all of the ozonation off gas, while the nitrogen and carbon dioxide contaminants that are contained in the off gas are left in it. The dried off gas is mixed with oxygen enriched gas from the original source, and the resulting mixture is delivered to the ozone generator for the production of more ozone. Another portion of the ozonation off gas is diverted upstream for introduction into the oxygen treatment facility of the activated sludge treatment plant. (Sinha-OEIS)
W79-06624

PROCESS FOR THE HYGIENIC ELIMINATION OF SEWAGE CONTAINING SALT-CONTAINING ORGANIC SUBSTANCES,
Von Roll A. G., Gerlafingen (Switzerland). (Assignee).
E. Filzmoser.
U.S. Patent No. 4,132,640, 6 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 235, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Industrial wastes, *Organic wastes, Water pollution treatment, Separation techniques, Incineration, Gases, Equipment, Oxidation, Combustion chamber.

A process is described where the concentrated industrial sewage is initially finely atomized, its remaining water percentage is evaporated by means of a hot gaseous medium accompanied by direct contact and as a result the dry substance in the sewage is separated. The thus obtained dry substance is pneumatically fed into a hot combustion chamber by means of an oxygen-containing carrier gas. Due to the rapid heating the salt suddenly passes into the gaseous phase without salt fusion and the organic substances are oxidized. The hot flue gases formed during the combustion of the organic substances and the salts in the gas phase are removed from the combustion chamber and rapidly cooled by means of air or water or both. The salts are removed from the flue gases which are discharged into the atmosphere. (Sinha-OEIS)
W79-06625

SLUDGE AND SLIME SEPARATING AND SETTLING DEVICE,
A. O. V. Hellqvist.
U.S. Patent No. 4,132,643, 5 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 236, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Water pollution treatment, Separation techniques, Slimes, Sludge, Solid wastes, Equipment.

This invention is related to a sludge and slime separating and settling device for treating all kinds of domestic waste water effluents. It is comprised of a container with a bottom and a lower, truncated conical part, an upper, truncated conical part with a spillover overflow extending around the upper edge, and an intermediate cylindrical part. The inlet is in the vertical direction in the middle of the container. The container is closed with a cover provided with an annular flow barrier wall extending from above the overflow level and dipping into the container. The device is preferably prepared from a plastic material, such as polyethylene or polypropylene. (Sinha-OEIS)
W79-06626

TWO-STAGE OIL SKIMMER SEPARATOR,
Sun Oil Co., Philadelphia, PA. (Assignee).
J. C. Bottomley, and H. G. Nash.
U.S. Patent No. 4,132,645, 5 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 237, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Oil pollution, Water pollution treatment, *Separation techniques, Skimming, Heat treatment, Equipment, Oil refinery, Gravity separation.

A Two stage oil skimmer separator for separating a hydrocarbon, such as oil or wax, from the water in a hydrocarbon-water mixture is of particular utility for the output from an oil refinery storm sewer system. The first stage of the separator includes a tank which allows gravity separation of the hydrocarbon and water. The floating hydrocarbon is skimmed off the top and directed to a second stage separator. The settled water passes under a baffle to retain the hydrocarbon within the system while passing the water out of the separator. The skimmed hydrocarbon, containing some water, is directed to the second stage where it is heated to facilitate further separation. The hydrocarbon is passed from the top of the second stage to storage tanks in the refinery. The water in the bottom of the second stage tank is returned to the first stage for further separation. (Sinha-OEIS)
W79-06627

AGENT FOR REMOVING HEAVY METALS,
Chisso Corp., Osaka (Japan). (Assignee).
R. Tarao, K. Kaku, M. Hayashi, T. Nakamura, and S. Ohishi.
U.S. Patent No. 4,133,755, 11 p, 10 tab, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 2, p. 613, January 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Heavy metals, *Mercury, Water pollution treatment, Absorption, Granules, Dithiocarbamate compounds.

Heavy metals such as mercury are removed from waste water by passing the waste water through a column packed with a granulated product containing a dithiocarbamate compound, amorphous silica and active carbon powder. The granulated product is obtained by blending and shaping these materials together with a binder composed mainly of vinyl acetate polymer resin and an excipient composed mainly of clay. The granulation method is carried out by blending a composition consisting of a dithiocarbamate bond-containing low molecular weight compounds, active carbon powder and amorphous silica with water, an excipient composed mainly of a clay and a binder composed mainly of vinyl acetate polymer resin to obtain a blend having a water content of 25-35%, which is then subjected to extrusion-granulation. (Sinha-OEIS)
W79-06632

PROCESS FOR PURIFICATION OF WASTE WATER PRODUCED BY A KRAFT PROCESS PULP AND PAPER MILL,
National Aeronautics and Space Administration, Washington, DC. (Assignee).
M. F. Humphrey.
U.S. Patent No 4,134,786, 6 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 968, January 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Pulp wastes, Pulp and paper industry, Chemical reactions, Chemical precipitation, Separation techniques, Activated carbon, Lignins, Product recovery.

A method and means for purifying the waste water from paper and pulp mill wastes obtained from a mill using the Kraft process is described. First the lignins and lignin derivatives are precipitated from the waste stream with quaternary ammonium compounds. Next other impurities are removed by activated carbon produced from the cellulosic components of the water and then water is separated from the precipitate and solids. The activated carbon also acts as an aid to the separation of the water and solids. If recovery of lignins is also desired, then the precipitate containing the lignins and quaternary ammonium compound is dissolved in methanol. Upon acidification, the lignin is precipitated from the solution. The methanol and quaternary ammonium compound are recovered for reuse from the remainder. (Sinha-OEIS)
W79-06638

METHOD OF PURIFYING WASTE WATER,
Swenska Sockerfabriks AB, Malmo. (Assignee).
H. Skogman, and L. Huss.
U.S. Patent No 4,134,830, 5 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 981-982, January 16, 1979.

escriptors: *Patents, *Waste water treatment, Water pollution treatment, *Organic wastes, Carbohydrates, Proteins, Biological treatment, Anaerobic conditions, Aerobic conditions, Activated udge, Separation techniques, Sludge treatment, ugar industry.

method of purifying waste water rich in carbohydrates or proteins is based on biological purification in two stages, a first anaerobic stage and a cond aerobic stage. In the anaerobic stage the udge content is kept at a high level, while selecting the conditions so that methane fermentation ith subsequent reduction of the pollutants is obined. Water containing sludge, formed in the naerobic stage, is subsequently exposed to sludge paration while forming a first sludge concentrate hich is returned to the anaerobic stage, i.e., it is circulated. After the sludge separation, the water eated in the first stage is treated in the aerobic age, where remaining pollutants, thanks to the nversion in the anaerobic stage, are present in ich a form, that they can easily be utilized by erobic organisms. The sludge-bearing water rmed in the aerobic stage is subjected to sludge paration while forming a second sludge concenate at least a portion of which is returned to the erobic stage while possible surplus is recirculated the anaerobic stage. Sludge from the first sludge ncentrate and possibly also from the second udge concentrate is drawn off and taken away for isposal. (Sinha-OEIS)
79-06639

ATER RECYCLE UNIT-GREY WATER LEARIFIER,
. J. McCormick.
.S. Patent No 4,134,833, 6 p, 3 fig, 6 ref; Official azette of the United States Patent Office, Vol 78, No 3, p 982, January 16, 1979.

escriptors: *Patents, *Waste water treatment, Water pollution treatment, *Water reuse, Water urification, Domestic water, Separation techiques, Recycling, Filtering, Grey water, Settling.

he primary object of this invention permits water be recycled indefinitely for certain operations, uch as washing, so that the overall, total use of ater in households, and in certain industries can e substantially reduced. A water recycle unit for roducing clear water output from grey water nput comprises a container which has sufficient apacity to provide the time required for the grey ater input to go through all of the physical hanges needed to provide a clear water output. hese physical changes include the settling of eavy materials, such as sand and dirt, to a lower one and the rising of lighter materials, such as oil nd fibers, to an upper zone to leave a central zone f clear water between the lower and upper zones ithin the container. The container includes outlet penings located in a side wall of the container at a evel which is normally above the upper side of the one of clear water within the container. A gate within the interior of the container includes a losed passageway for removing clear water from he central zone through the outlet in response to he inflow of additional grey water. A clear water ollecting and filter box is built alongside of and ntegrally with the container. (Sinha-OEIS)
W79-06641

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5A.
W79-06722

OIL/WATER SEPARATION: STATE-OF-THE-ART,
Rutgers - the State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
F. A. Osamor, and R. C. Ahlert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 755, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-069, April 1978. 106 p, 10 fig, 4 tab, 176 ref. R803978.

Descriptors: *Waste water treatment, *Water pollution treatment, *Oil spills, *Oil pollution, Oil wastes, Water pollution sources, Oily water, Filtration, Membrane processes, Reverse osmosis, Adsorption, Separation techniques, Absorption, Specifications, Chromatography.

Devices and processes for oil/water separation are classified into 11 categories according to the primary mechanism inducing the separation. The characterization of oil/water systems is examined, followed by a parallel characterization of oily waste waters. The basic principle of each category of devices or processes and the specific design features, operational modes, and limitations are discussed. Literature on test evaluation of a number of devices is reviewed on the basis of actual or potential success in treating oil/water system conditions. No single technique is capable of separating all oil/water system conditions efficiently, although reverse osmosis, ultrafiltration, and carbon adsorption have great potential. The high equipment and operation costs of these limit their use for treating oily waste streams. For production of effluents with the desired discharge quality of less than 10 ppm of oil, a combination of devices in a process change is necessary. The specific characteristics of an oily waste water regulate the combination of devices that give the required effluent concentrations. (Davison-IPA)
W79-06775

PROCEEDINGS, FIFTH UNITED STATES/JAPAN CONFERENCE ON SEWAGE TREATMENT TECHNOLOGY,
Environmental Research Center, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 216, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/9-77-027, December 1977. Conference held in Tokyo, Japan, April 18-22, 1977. 578 p, 282 fig, 186 tab, 339 ref.

Descriptors: *Conferences, *Sewage treatment, *Industrial waste treatment, Water pollution treatment, Activated carbon, Filtration, Technology, Government finance, Water quality control, Management, Water reuse, Run-off, Combined sewers, Sewage, Water pollution control, Monitoring.

The 16 papers presented at a joint U.S.-Japan conference on sewage treatment technology are compiled. The five Japanese papers describe industrial waste water control into public sewers, storm and combined sewer overflows; regeneration of granular activated carbon; deep aeration tanks; upgrading existing plants by chemical addition to aeration tanks; and rapid sand filtration process for tertiary purpose. The topics covered by the U.S. series of papers includes control of non-point source pollution; use of new technology in the EPA Construction Grant Program; Georgia's water quality control program Federal-State-regional participation in the development of a waste water management plan; regional domestic waste water management; urban run-off pollution control technology; waste water reuse; industrial waste water pre-treatment and joint treatment; criteria and assessment of waste treatability; biological nitrogen and phosphorus control; and water reclamation technology. It is concluded that the technology exchange program and conference were valuable to both countries. (Davison-IPA)
W79-06779

RECENT DEVELOPMENTS IN THE SANDIA LABORATORIES' SEWAGE SLUDGE IRRADIATION PROGRAM,
Sandia Lab., Albuquerque, NM.
H. D. Sivinski, J. R. Brandon, M. E. Morris, K. S. Neuhauser, and R. L. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-1411, Price codes: A04 in paper copy, A01 in microfiche. Report no. SAND-77-1411, November 1977. 70p, 14 fig, 23 tab, 33 ref. AT(29-1)-789.

Descriptors: *Sludge treatment, *Irradiation, *Heat treatment, *Sludge disposal, Waste storage, Bacteria, Viruses, Pathogenic bacteria, Feeds, Dewatering, Laboratory tests, Investigations, Waste treatment, Sludge, Organic wastes, Liquid wastes.

Recent pathogen reduction work, sludge processing costs, agronomics and animal refeeding studies, and product enhancement and physical/chemical effects are reviewed. Studies show that irradiation with 1 Mrad effectively eliminates pathogenic bacteria and viable parasite ova in liquid sludges. Heat is effective in reducing the levels of pathogenic bacteria, Ascaris ova, and viruses. Ammonia was shown to be virucidal to poliovirus and other enteric viruses. That effects of irradiation of sludges on dewatering properties are not significant compared to polymers was shown by physical/chemical effects studies. When used as a feeding supplement for sheep and cattle, dried irradiated undigested sludge was shown to have significant nutritional value; no significant harmful effects have been demonstrated in this feeding program. Most of the work reported has been done in liquid sludges, but the emphasis in the program has shifted to the treatment of dried sludges. A status report on the dried sludge irradiator being built is included. (Davison-IPA)
W79-06782

MARKETING FEASIBILITY OF USING CEDAR MILL WASTE FOR OIL SPILL CLEAN-UPS,
Northern Maine Regional Planning Commission, Caribou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 476, Price codes: A04 in paper copy, A01 in microfiche. Final Report No. EDA 78-059, February 1978. 54 p, 10 append. 01-6-01535.

Descriptors: *Oil spills, *Water pollution, *Water pollution abatement, Waste treatment, Recycling, Industrial wastes, Water pollution treatment, Absorption, Marketing techniques, Wood wastes, Research and development, Specifications.

An excelsior product developed from cedar mill wastes has the potential for use in oil spill clean-ups and industrial oil-type removal processes. The first step in a three-phase market study involved drawing up a list of specifications as best as could be done without controlled laboratory testing. The specifications covered all the important areas concerning oil spill clean-up such as product density, absorption, efficiency, and disposability. The specification information was obtained through using a small testing tank at the lumber company where the product was developed. The second step of the study involved developing the questionnaire which consisted of seven questions on the market potential of the product and its packaging. The third step was the development of an introductory letter explaining the project and the most important aspects of the proposed product. The market study package was sent to interested contractors. This cedar residue has a very high absorption ratio compared with other absorbents used today. Lake, pond, and stream oil spills; industrial transfer accidents; and small oil spills on the open sea and around docks are some possible uses for this product. (Davison-IPA)
W79-06788

FULL-SCALE DEMONSTRATION OF NITROGEN REMOVAL BY BREAKPOINT CHLORINATION,
Stone (Richard W.) Sacramento, CA.
R. W. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 657, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-029, March 1978. 80 p, 31 fig, 7 tab, 6 ref, 2 append. S-803343-01-0.

Descriptors: *Waste water treatment, *Chlorination, *Evaluation, On-site investigations, Chemical reactions, Alkalinity, Design criteria, Ammonia, Nitrogen, Oxidation, Nitrates, Water pollution

sources, Water purification, Water pollution treatment, Water pollution control, Water quality control, Water treatment, Municipal wastes, Rancho Cardova(California).

A large-scale demonstration program was carried out to establish design and operating criteria of breakpoint chlorination for nitrogen removal systems for use in municipal waste water treatment applications. Breakpoint chlorination process chemistry is discussed, chemical consumption is evaluated, and process control recommendations are made. The theoretical dosage of chlorine required to convert 1.0 mg/l of ammonia nitrogen to nitrogen gas is 7.6 mg/l; an average dosage of 10 mg/l chlorine was required in the process evaluated. The difference between these dosages was due to chlorine consumption from the oxidation of ammonia nitrogen to nitrate nitrogen which is a competing side reaction having a less desirable end product. About 96% of the chlorine dosed to the system was accounted for in reactions between chlorine and nitrogenous species in specific, identified chemical pathways, and as free chlorine remaining in solution following breakpoint. The rate of the breakpoint reaction varied depending on the system pH; the fastest rates were at a pH of 7.0. This evaluation showed that the process requirement for alkalinity supplementation was nearly exactly equal to that predicted from the chemical stoichiometry. (Davison-IPA)
W79-06791

DESIGN OPTIMIZATION OF HIGH-RATE DISINFECTION USING CHLORINE AND CHLORINE DIOXIDE,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
D. F. Geisser, S. R. Garver, and C. B. Murphy, Jr.
Journal of the Water Pollution Control Federation, Vol 51, No 2, p 351-357, February 1979. 9 fig, 3 tab, 15 ref.

Descriptors: *Design, *Optimization, *Disinfection, *Effects, *Regression analysis, *Waste water treatment, *Chlorine compounds, Performance, Coliforms, Evaluation, Equations, Mathematical models, Systems analysis, Cost minimization, Cost effectiveness.

Pilot-plant treatability studies of high-rate disinfection with chlorine and chlorine dioxide were conducted in Rochester, New York as part of the Combined Sewer Overflow Abatement Program for the Monroe County Division of Pure Waters. Using data acquired during the pilot-plant investigations, mathematical performance models were developed for both chlorine and chlorine dioxide disinfection cost and performance comparisons of chlorine and chlorine dioxide for several alternative treatment systems. Optimization analysis results indicated that a high-rate disinfection system using short detention times and high-intensity mixing appears to be a more cost-effective technique than either a corrugated baffle or conventional system for the disinfection of Rochester combined sewer overflows. In general, the use of chlorine is preferred over chlorine dioxide on a cost-performance basis. (Bell Graf-Cornell)
W79-06803

PUTTING SLUDGE TO WORK.
Ground Water Age, Vol. 13, No. 8, p 22, April, 1979. 1 fig.

Descriptors: *Water reuse, *Recycling, Sludge disposal, Sewage treatment, Waste water(Pollution), Groundwater, Water quality.

A unique approach to wastewater renovation, developed by Michigan State University, uses a system of lakes, marshes, and irrigation in conjunction with a conventional wastewater treatment plant. The advantages of this system are that biological materials can be harvested and used, nutrients can be recycled, and municipal wastewater can be cleaned in a process that requires no pretreatment and uses solar energy. Lake vegetation absorbs nutrients in the wastewater and is harvested for compost or animal feed. Water from the lakes is applied to a nearby land system through spray irrigation. The MSU system has an extensive array of wells to monitor ground water quality. This system promises to be economical both on a short-term and a long-term basis. However, it may not be practical for large communities due to the land areas required. (Purdin-NWWA)
W79-06805

BIOLOGICAL TREATMENT, EFFLUENT REUSE, AND SLUDGE HANDLING FOR THE SIDE LEATHER TANNING INDUSTRY,
Polkowski, Boyle and Associates, Madison, WI.
L. B. Polkowski, W. C. Boyle, and B. F. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 676, Price codes: A12 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-013, February 1978. 246 p, 88 fig, 83 tab, 6 ref, 3 append. 12120 DSG.

Descriptors: *Biological treatment, *Industrial wastes, *Tannery wastes, *Evaluation, Sludge disposal, Waste treatment, Water reuse, Water pollution treatment, Water conservation, Leachate, Chemical analysis, Effluents, Liquid wastes, Water pollution, Solid wastes.

The treatability of unsegregated, unequalized, unneutralized waste waters from a side-leather tanning industry using the hair pulping process by primary and secondary biological treatment methods is evaluated. Screening and gravity separation in clarifier-thickeners comprised the primary treatment; the secondary treatment method utilized aerated ponds and final clarifiers capable of recycling biological solids. The system was operated over a wide range of detention times during seasonal variations with monthly temperature ranges from -14C to 30C, and with and without solids recycle and nutrient addition. Generally, the results indicated that the system is unable to meet the Best Practicable Treatment and Best Available Treatment guidelines which served as a comparison. Except for oil and grease, the raw waste water characteristics for this type of processing were within EPA guideline limitations. In evaluating the effects of water conservation practice on leather qualities and to determine conservative substances buildup in the waste water effluent, the secondary treatment effluent was used in the beamhouse operations under test conditions. (Davison-IPA)
W79-06865

TREATMENT AND RECOVERY OF FLUORIDE AND NITRATE INDUSTRIAL WASTES: PHASE II,
Grumman Aerospace Corp., Bethpage, NY.
C. J. Staebler, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 159, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-048, March 1978. 85 p, 29 fig, 18 tab, 26 ref. S800680.

Descriptors: *Waste water treatment, *Industrial wastes, *Byproducts, Fluorides, Nitrates, Ion exchange, Effluents, Centrifugation, Water purification, Calcium compounds, Fertilizers, Analytical techniques, Sludges, Equipment, Evaporators, Water pollution treatment, Waste treatment, Sludge treatment.

The laboratory and pilot-scale techniques described were developed to treat selected chemical processing solutions and rinse waters containing fluorides, nitrates, and to recover usable byproducts. The following lime treatment parameters were optimized for various fluoride and nitrate effluent levels: temperature, retention time, pH, and slurry concentration. Ion exchange techniques which reduced rinse water concentrations of fluoride to 3 ppm and nitrate to 10 ppm were developed. Pilot-scale centrifugal techniques were developed to separate calcium fluoride and metal hydroxide sludges. In the optimized pilot-scale system the nitrate concentration of centrifuged effluents was reduced from 28,000 to less than 5 ppm by passing these effluents through a thin film, mechanically aided evaporator. The pilot treatment system reduced fluoride concentration from 117,000 to less than 1 ppm. Chemical and mechanical property tests revealed that calcium fluoride sludge is potentially feasible as a strength-maintaining additive for concrete. Greenhouse tests indicated that concentrated calcium nitrate recovered from the mechanically aided evaporator is a beneficial and practical plant fertilizer. The economics and production scale-up plans for ion-exchange rinse water treatment and process treatment are presented. (Davison-IPA)
W79-06869

EVALUATION OF THE RBC PROCESS FOR MUNICIPAL WASTEWATER TREATMENT,
Pewaukee, WI.
D. L. Kludge, R. J. Kipp, and C. J. Crandall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 496, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-028, March 1978. 104 p, 48 fig, 62 tab, 9 append. S802905.

Descriptors: *Waste water treatment, *Rotating biological contactor, *Trickling filter, Nitrification, Phosphorus, Biochemical oxygen demand, Suspended solids, Treatment facilities, Water pollution treatment, Water quality standards, Evaluation, Pewaukee(Wisconsin).

The rotating biological contractor (RBC) was operated as a full scale process at the Pewaukee, Wisconsin, waste water treatment plant to determine if it could consistently produce an effluent phosphorus concentration below 1.5 mg/ (total phosphorus) and biochemical oxygen demand (BOD) and suspended solids (SS) levels below 15 mg/l. In Phase I the effectiveness and efficiency of the process was demonstrated, evaluated, and compared with a parallel 1136 m3/day (0.30 mgd) trickling filter. Superior BOD and SS values were obtained with the RBC process, but better nitrification was obtained with the trickling filter. In Phase II phosphorus removal was demonstrated and evaluated; treatment was upgraded by the addition of alum and ferric chloride to the RBC process at two feed points upstream and downstream from the RBC units. The results indicated that although the mineral addition improved RBC phosphorus removal, the BOD and SS values of the effluent deteriorated. This occurred regardless of the location of the mineral addition or the cation species used for phosphorus removal. It is concluded that the RBC process effluent met and exceeded the secondary treatment standards, and that it gave a superior effluent quality regarding BOD and total SS than the trickling filter. (Davison-IPA)
W79-06872

SORBENTS FOR FLUORIDE, METAL FINISHING, AND PETROLEUM SLUDGE LEACHATE CONTAMINANT CONTROL,
New Jersey Inst. of Tech. Newark.
P. C. Chan, R. Dresnack, J. W. Liskowitz, A. Perna, and R. Trattner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 696, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-024, March 1978. 93 p, 30 fig, 12 tab, 18 ref. R803717.

Descriptors: *Sorbents, *Waste treatment, *Leachate, *Industrial wastes, *Sludge, Wastes, Fluorides, Alkalis(Bases), Oil wastes, Clays, Illite, Kaolinite, Activated carbon, Fly ash, Lysimeters, Zeolites, Cullites.

The use of ashes, vermiculite, illite, activated carbon, kaolinite, natural zeolite, activated alumina, and cullite was investigated to determine their capability to remove leachate contaminants produced from the three industrial sludges: calcium fluoride, metal hydroxide, and petroleum. Leachate analysis showed considerable variations in composition and concentration of the constituents in leachate prepared from the same industrial sludge. Batch and lysimeter studies evaluating the static and dynamic sorbent capacity for the leachate constituents revealed that no single sorbent can be used to reduce the concentration of leachate constituents; combinations of two, three, or four

ents are capable of reducing them. The combi-
on, activated carbon and activated alumina,
more effective for treating calcium fluoride
ge leachate, and less effective than ash and
combinations in treating metal finishing and
oleum sludge leachates. The selection of a sor-
combination is sludge leachate specific. Sor-
s under dynamic conditions achieved greater
cities for the measured contaminants in the
hates than were achieved under static condi-
s. Change in pH of the sorbent from acidic to
line favored the removal of cations. (Davison-
)
9-06873

ST ALLOCATION FOR A REGIONAL STEWATER TREATMENT SYSTEM,
International, Menlo Park, CA.
oehman, J. Orlando, J. Tschirhart, and A.
nston.
er Resources Research, Vol. 15, No. 2, p 193-
April 1979. 3 fig, 6 tab, 22 ref.

criptors: *Cost allocation, *Waste water treat-
t, *Game theory, *Least-cost regionalization,
bability, Systems analysis, Equations, Meramec
er basin(Missouri), Effluent dischargers, Eco-
ic benefits, Environmental benefits, Economies
cale, Incentives, Shapley value.

re are economies of scale in the construction of
onal wastewater treatment systems. Effluent
hargers have the option of participating in a
onal system or constructing separate smaller
ems. In order to encourage participation in a
onal system so that the economies are realized,
cost allocation method employed must offer
nomic incentives. The cost allocation problem
ewed in game theoretic terms, and the Shapley
e (a game theory solution) is suggested as an
cation method. The method is applied to the
amec River Basin in Missouri where eight
hargers are identified. The problems of appli-
on are discussed and the reactions of the eight
hargers are cited. (Bell Graf-Cornell)
9-06929

STEWATER TREATMENT CAPACITY EX-
NSION WITH TIME-VARYING ASSIMILA-
E CONSTRAINTS,
W Systems Group, Redondo Beach, CA.
aziw, and C. R. Scherer.
ter Resources Research, Vol. 15, No. 2, p 219-
April 1979. 6 fig, 5 tab, 9 ref.

criptors: *Waste water treatment, *Dynamic
gramming, *Analytical techniques, *Receiving
er, *Capacity expansion, *Cost minimization,
ndards, Effluents, Constraints, Optimization,
nning, Effects, Discount rate, Equations, Math-
atical models, Systems analysis, Equations, Pol-
nt removal rates, Hydraulic demand.

timal waste water plant capacity expansion is
xamined for the general case where effluent
eiving water standards vary with time. A deter-
istic dynamic programming framework is used
determine cost-minimizing expansion plans for
ste water treatment when hydraulic demand is
med known and nondecreasing with time. The
ct of discount rate, initial hydraulic capacity,
initial plant pollutant removal rate on expan-
n plan is investigated. Results show time-vari-
e effluent receiving standards can significantly
uence cost-minimizing expansion plans. (Bell
af-Cornell)
9-06930

NDLING AND DISPOSAL OF SLUDGES
OM COMBINED SEWER OVERFLOW
EATMENT: PHASE III--TREATABILITY
UDIES,
virex, Inc., Milwaukee, WI. Environmental Sci-
es Div.
Osantowski, A. Geinopolis, R. E. Wullschleger,
M. J. Clark.
ailable from the National Technical Information
vice, Springfield, VA 22161 as PB-281 006,
ce codes: A12 in paper copy, A01 in microfiche.
Report No. EPA-600/2-77-053c, December 1977. 272 p, 51 fig, 142 tab, 18 ref, 5 append. 68-03-0242.

Descriptors: *Combined sewers, *Sludge, *Sludge treatment, *Centrifugation, *Anerobic digestion, *Dewatering, Economics, Capital costs, Operating costs, Municipal wastes, Sewage, Sewage treatment, Kenosha, Racine, Milwaukee(Wisconsin).

Results of a project evaluating the handling and disposal of combined sewer overflow (CSO) treatment residuals are reported. At Kenosha, Racine and Milwaukee, Wisconsin, CSO sludges were thickened and dewatered using a mobil centrifuge sludge dewatering van. A bench scale anaerobic digestion system was used to evaluate anaerobic digestion of the sludges. To compare the use of thickening-centrifugation for dewatering CSO sludges and municipal sewage treatment plant sludges, each city's dry-weather treatment plant sludge was also tested using the thickening-centrifugation process. The results indicate dewatering of CSO sludges appears feasible when sludges are first degritted, if required, and thickened before centrifugation. Under optimum centrifuge operating conditions thickened sludges were dewatered to Cake concentrations with solids recoveries ranging from 80% to 99%. The dewatering characteristics of wet-dry weather sludge mixtures at Kenosha were similar to those for CSO sludge alone. According to the bench scale anaerobic digestion studies no significant adverse effect was realized by adding CSO generated sludges to dry-weather digesters at similar feed rates to those expected from a typical storm. Preliminary estimates indicate that first investment capital costs for thickening-centrifugation of CSO sludges ranged from $0.31 million to $2.92 million with annual costs ranging from $49,000 to $659,300/year for handling 4.0 to 36.5 tons/day of dry sludge. (Davison-IPA)
W79-06946

PILOT INVESTIGATION OF SECONDARY SLUDGE DEWATERING ALTERNATIVES,
National Council of the Paper Industry for Air and Stream Improvements, Inc., Kalamazoo, MI.
R. A. Miner, D. W. Marshall, and I. Gellman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 982, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-014, February 1978. 126 p, 26 fig, 33 tab, 8 ref, 5 append. R-804019-01-0.

Descriptors: *Sludge treatment, *Pulp and paper industry, *Pulp wastes, *Bleaching wastes, Dewatering, Filtration, Centrifugation, Ultrafiltration, Industrial wastes, Waste treatment, Water pollution sources, Wastes.

The findings of a field investigation are reported in which the following eight pilot dewatering devices were operated on biological sludge from an integrated bleached kraft-fine paper mill: (1) pressure filtration, (2) precoat vacuum filtration, (3) filter belt pressing, (4) multiple role pressing, (5) capillary filter belt pressing, (6) capillary suction dewatering, (7) horizontal bowl centrifuging, and (8) ultrafiltration. Three levels of performance are indicated based upon a criterion of attainable cake consistency: (1) pressure filtration and precoat vacuum filtration generated the driest cakes; (2) filter belt pressing produced cakes of intermediate consistencies; and (3) the low cake consistencies were produced by gravity filtration, centrifugation and ultrafiltration. It was found that performance was severly affected by changes in feed sludge consistency, the amount of sludge conditioning, and the sludge's specific resistance to filtration. The extreme variability of the type and amount of sludge conditioning required depended on the dewatering technique being used, the level of performance expected of it, and the consistency and nature of the sludge being dewatered. (Davison-IPA)
W79-06948

COAST GUARD RESPONSE TO OIL SPILLS--TRYING TO DO TOO MUCH WITH TOO LITTLE,
General Accounting Office, Washington, DC.
E. B. Staats.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 911, Price codes: A05 in paper copy, A01 in microfiche. Comptroller General's Report to the Chairman, Subcommittee on Transportation and Related Agencies, Committee on Appropriations United States Senate, May 16, 1978. 85 p, 14 fig, 5 append.

Descriptors: *Oil spills, *Waste water treatment, *Water pollution control, *Pollution abatement, *U S Coast Guard, Coasts, Oil wastes, Monitoring, Legislation, Federal Water Pollution Control Act, Water pollution sources, Water pollution treatment.

During the 1976 Coast Guard effectiveness in containing and cleaning up oil spills in five Coast Guard districts encompassing the Atlantic and Gulf coasts was reviewed. Because of the small quantities of oil spills reported for the Great Lakes, Pacific, and inland Coast Guard districts, they were not reviewed. Coast Guard response to all major and medium oil spills and a sample of minor spill occurring in the districts were analyzed. This analysis includes a chronology of events developed for each spill using Coast Guard, cleanup contractor, and spiller records, and interviews with officials. Coast Guard policies and procedures, training programs, personnel practices, contingency plans and pollution equipment capabilities were also examined. Results of this analysis indicate that the Coast Guard could have been more effective in about 38% of the cases in one or more of the following areas: faster responses to reported spills, better monitoring of cleanup operations, more effective action upon arrival at spills, attempting removal of spilled oil before it dissipates, and investigating reported oil spills of less than 10,000 gallons. The major limitations of the Coast Guard response to oil spills are staff shortages, inadequate training in the pollution abatement program, the need for additional equipment, improvement in its research and development program, and deficiences in contingency planning. (Davison-IPA)
W79-06949

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke, R. T. Heath, R. H. Kennedy, and M. R. McComas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 983, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-033, March 1978. 116 p, 30 fig, 31 tab, 66 ref, 1 append. 16010 HCS, R 801936.

Descriptors: *Eutrophication, *Lakes, *Phosphorus, *Water pollution control, Septic tanks, Water pollution sources, Algae, Trophic level, Limnology, Nutrients, Plankton, Bioindicators, Biomass, Water pollution effects, Epilimnon, Hypolimnon, Ohio.

Diversion of septic tank drainage reduced the symptoms of eutrophication in the East (ETL) and West (WTL) Twin Lakes in Northeastern Ohio. Phosphorus (P) in lakes and streams declined and plankton biomass after diversion, however, during the subsequent five year monitoring period P and biomass remained those of moderately eutrophic lakes and P income remained above the permissable level. It was assumed that the P loading was of hypolimnetic origin, and 139.55 M3 (36,919 gals) of alum were added to the hypolimnion of WTL in July 1975; ETL was used as a downstream control. Although hypolimnetic concentration in 1976 was lowered, the reduced net internal P loading continued at a significant rate suggesting the littoral as an internal source. Epilimnotic P was also lowered, and a reduction of symptoms was indicated by a Trophic State Index, but WTL remained eutropic in 1976. It is suggested that hypolimnetic applications of alum may be more effective in large lakes

where seiches and vertical entrainment of hypolimnetic P are more significant. Details for dose determination and application are provided in the appendix. (Davison-IPA)
W79-06950

PBI REVERSE OSMOSIS MEMBRANE FOR CHROMIUM PLATING RINSE WATER,
Celanese Research Co., Summit, NJ.
H. J. Davis, F. S. Model, and J. R. Leal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 944, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-040, March 1978. 36 p, 3 fig, 11 tab, 7 ref. R-803620.

Descriptors: *Waste water treatment, *Reverse osmosis, *Industrial wastes, *Polymers, Membranes, Fabrication, Heat treatment, Testing, Analytical techniques, Chromium, Polybenzimidazole.

Laboratory research wherein the attempt to develop a high temperature, oxidation-resistant reverse osmosis (RO) membrane of polybenzimidazole (PBI) for use in treating metal finishing effluents is reported. The effects of important casting variables and subsequent heat treatment on membrane RO properties were investigated. Membranes were tested on a high pressure circulating flow system in flat film test cells; screening was done by pretesting with a 5,000 ppm sodium chloride feed solution. A simulated rinse water containing chromic acid or plating bath solution was used to test membranes with optimum properties. PBI RO membranes were resistant to chromic acid attack. These same membranes exhibited high salt rejections when they were retested with sodium chloride which demonstrated that they had not been chemically attacked by chromic acid. Membranes pretreated with 5,000 ppm sodium tungstate tolution achieved significant improvement in long-term rejection of chromic acid; this was further improved by the continuous addition of sodium tungstate to the feed solution. Use of this approach to long-term high level rejection of chromic acid is an unacceptable practice due to the possible contamination of the plating bath by tungstate ions. Although membrane performance was improved by membrane treatment and feed pH adjustment, the project failed to develop an acceptable membrane to treat chromium plating rinse water. (Davison-IPA)
W79-06951

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 471, Price codes: A13 in paper copy, A01 in microfiche. Report EPA 430/9-77-015, 1978. 232 p, 48 tab, 2 ref, 7 append.

Descriptors: *Municipal wastes, *Waste water treatment, *Cost analysis, *Cost comparisons, *Performance, Personnel, Operating costs, Maintenance costs, Efficiencies.

The operation and maintenance costs of municipal waste water treatment plants and collection systems were surveyed and analyzed. Costs are presented for different levels of waste water treatment, types of plants and collection systems, and segregated cost categories. Analyses are presented on relative costs for certain treatment variables and characteristics. Cost data utilized ranged from fourth quarter 1972 to first quarter 1977. Costs are adjusted to third quarter 1977 dollars. Only treatment plants of 1.0 mgd capacity or larger were sampled. A computer statistical package was used in the analysis. For all types of treatment levels, personnel, power, and chemical expenditures accounted for approximately 80% of total operating costs. Operating efficiency analyses indicated that the larger the plant, the lower the operation and maintenance costs per million gallons treated. Also, the more sophistoicated the treatment process, the more costly waste is to treat. The total operating costs are highest for sanitary sewer systems and lowest for mixed systems which have sanitary sewers plus storm sewer systems. (Small-FRC)
W79-06955

TRACE ORGANIC VARIATION ACROSS THE WASTEWATER TREATMENT SYSTEM OF A CLASS-B REFINERY,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. A. Raphaelian, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 596, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/7-78-125, 1978. 183 p, 7 fig, 19 tab, 6 ref, 5 append.

Descriptors: *Pilot plants, *Activated carbon, *Activated sludge, *Industrial wastes, *Oil industry, Performance, Organic compounds, Filtration, Waste water treatment.

The efficiency of a pilot-scale granular activated carbon sludge treatment system of a Class B petroleum refinery that met BPT in 1977, was evaluated. Effluents at SOHTO's Toledo refinery from the full-scale system (dissolved-air-flotation unit and final clarifier for the activated-sludge unit) and an add-on pilot scale unit (mixed media filter and activated carbon columns) were sampled for analysis of common waste water parameters and trace organic compounds. Four-day composites of daily samples were analyzed using capillary-column gas chromatography/mass spectrometry. The activated sludge unit removed aromatic compounds better than it did nonaromatics while the activated carbon unit was better at removal of nonaromatics. Average percentage removal of organics present in the DAF effluent was more than 99% for activated sludge, about 0% for mixed-media filter, and less than 1% for activated carbon. Eighty-one percent of the less than 1% of trace organics remaining in the final-clarifier effluent were removed by the activated carbon. These removal estimates are only approximate. (Small-FRC)
W79-06956

TREATMENT OF PACKINGHOUSE WASTEWATER BY INTERMITTENT SAND FILTRATION,
East Central Oklahoma State Univ., Ada.
M. L. Rowe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 768, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-205, 1978. 71 p, 13 fig, 30 tab, 25 ref, 1 append.

Descriptors: *Filtration, *Waste water treatment, *Food processing industry, *Aerated lagoons, *Standards, Biochemical oxygen demand, Suspended solids, Coliforms, Ammonia, Oil.

The use of intermittent sand filters as a means of upgrading waste treatment systems for small packing houses was evaluated. The treatment system examined consisted of an extended aeration lagoon in series with an intermittent sand filter. A filter run of 109 days was observed with a hydraulic loading rate of 0.36 mgd and a sand source having an effective diameter of 0.35 mm and a uniformity coefficient of 2.5. The average BOD was 10.4 mg/liter and the average TSS was 11.1 mg/liter. When the 1983 BAT limitations were considered, the effluent met the maximum day limit for TSS but the 30-day average value for TSS was exceeded. The effluent met the limits for fats, oils, grease, and pH. The NH3-N in the effluent from the treatment system met the BAT limits which were recinded by the court. The fecal coliform limits were also exceeded. It was also determined that the small packinghouse managers should use a commercial laboratory when monthly or quaterly analyses are specified. (Small-FRC)
W79-06957

REMOVAL OF HEAVY METALS FROM INDUSTRIAL WASTEWATERS USING INSOLUBLE STARCH XANTHATE,
Science and Education Administration, Peoria, IL. Northern Regional Research Center.
R. E. Wing, L. L. Navickis, B. K. Jasberg, and W. E. Rayford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 792, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-085, 1978. 116 p, 20 fig, 55 tab, 69 ref.

Descriptors: *Polyelectrolytes, *Chemical precipitation, *Heavy metals, *Separation techniques, Copper, Ammonia, Sodium, Magnesium, Absorption, Ions, Sludge, Waste water treatment, Industrial wastes.

Insoluble starch xanthate (ISX) was found effective in bench-scale tests in the removal of heavy metal ions from several industrial effluent streams. ISX was applicable over the pH range of 3-11, in the presence of salt concentrations of 0-10%, and in batch or continuous flow systems. In the bench-scale tests, ISX in combination with alum reduced residual copper to less than 0.02 mg/liter without filtration in brass mill effluent. In lead battery waste water, residual lead decreased to less than 0.05 mg/liter with ISX treatment. The material also effectively removed copper ammonia complexes in circuit board copper etchant rinse waters. The ISX-metal sludge readily settles, dewaters to about 25-50% solids with filtration or centrifugation, and the ISX adds only sodium and magnesium ions to the treated water. Treatment processes were developed for removing copper from electroless copper plating and copper pyrophosphate electroplating rinse waters utilizing ISX. (Lisk-FRC)
W79-06964

CHARACTERIZATION OF REUSABLE MUNICIPAL WASTEWATER EFFLUENTS AND CONCENTRATION OF ORGANIC CONSTITUENTS,
Gulf South Research Inst., New Orleans, LA.
J. K. Smith, A. J. Englande, M. M. McKown, and S. C. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 547, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-016, 1978. 143 p, 18 fig, 53 tab, 10 ref, 1 append.

Descriptors: *Tertiary treatment, *Performance, *Water quality, *Standards, *Municipal wastes, Reverse osmosis, Ammonia, Nitrate, Phenols, Odor, Turbidity, Heavy metals, Potable water, Public health.

Organic concentrates were collected from operating advanced waste water treatment plants for use in health effects testing. After reverse osmosis, the organics were further concentrated and then recovered by liquid/liquid extraction. Also, chemical, physical, and biological analyses were conducted of effluent to determine how the quality of the effluents compared with drinking water criteria. All advanced treatment plants tested were characterized by high quality effluents. Spot samples taken over a six to nine month period at six plants determined that nitrogen (ammonia and nitrate), phenol, odor, carbon chloroform extract, turbidity, and specific heavy metals exceeded drinking water standards in most cases. The plants tested were: Lake Tahoe, California; Blue Plains, District of Columbia; Pomona, California; Dallas, Texas; Escondido, California; and Orange County, California. (Small-FRC)
W79-06966

IMPROVED TREATMENT OF LIME-SULFIDE TANNERY UNHAIRING WASTE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 616, Price codes: A02 in paper copy, A01 in microfiche. Report 1977. 8 p, 2 tab.

Descriptors: *Waste treatment, *Tannery wastes, *Flocculation, *Hydrogen sulfide, *Flash distillation, Separation techniques, Industrial wastes.

lvancements in the treatment of lime-sulfide unring wastes from both salt-cured and unsalted les are discussed. Undissolved lime is flocculated t of the waste of salt-cured hide, and the superant is acidified to liberate hydrogen sulfide. drogen sulfide is flashed off under reduced pres-e at about 100 to 150F. Waste from unsalted les is sparged with carbon dioxide before floccuon, the sparged waste is flocculated with a ongly cationic polyelectrolyte, and the hydron sulfide flashed off from the acidified supernat liquid. (Small-FRC)
79-06967

RFORMANCE EVALUATION OF AN EXTING SEVEN CELL LAGOON SYSTEM,
ah Water Research Lab., Logan.
H. Reynolds, R. E. Swiss, C. A. Macko, and E. Middlebrooks.
ailable from the National Technical Information rvice, Springfield, VA 22161 as PB-273 533, ce codes: A08 in paper copy, A01 in microfiche. port EPA-600/2-77-086, 1977. 185 p, 29 fig, 49 , 46 ref, 5 append.

scriptors: *Oxidation lagoons, *Sewage lagoons, erformance, *Standards, *Biochemical oxygen mand, Coliforms, Suspended solids, Monitoring, ah, Design criteria, Design standards, Waste ter treatment, Sampling, Municipal wastes.

e performance of a seven cell faculative waste bilization lagoon system treating waste water m a population of 471 persons was evaluated l compared with federal and Utah effluent disarge standards. Sampling of the lagoon systems nsisted of: 24-hr composite raw influent samples; ividual pond effluent samples collected twice a ek for 13 months; and seasonal collections for 30 nsecutive day periods during the same 13 month riod. Samples were analyzed for BOD, soluble OD, suspended solids, volatile suspended solids, ODm soluble COD, alkalinity, ammonia-, nitrate-itrite-, and total Kjeldahl-nitrogen, total phosorus, and total algae count. Temperature, pH, solved oxygen, fecal coliforms, fecal streptocci, total coliform bacteria, daily influent and luent flowrates, air temperature, wind, evaporan, and solar radiation were also monitored. The ulting data indicated that the federal discharge ndard of 30.0 mg BOD/liter was met during the dy but that 85% BOD removal was not attained 4 of the 13 months studied. In 8 of the months, luent met the 10.0 mg/liter BOD and 10.0 mg/r suspended solids Utah standard. Effluent conned less than 30 mg/liter suspended solids 10 of 13 months but failed to meet the federal rerement of 85% suspended solids removal 5 of 13 months. State and federal fecal coliform els were consistently met. Loading on the oon system exceeded the design criteria and sign equations were not adequate for predicting erall performance. (Lisk-FRC)
79-06968

N AGRO-POWER-WASTE WATER COMEX FOR LAND DISPOSAL OF WASTE EAT AND WASTE WATER,
nnsylvania State Univ., University Park. Inst. Research on Land and Water Resources.
R. DeWalle.
ailable from the National Technical Information rvice, Springfield, VA 22161 as PB-239 675, ce codes: A10 in paper copy, A01 in microfiche. port, 1974. 209 p, 49 fig, 49 tab, 55 ref, 1 append.

scriptors: *Ultimate disposal, *Application thods, *Sprinkler irrigation, *Thermal pollution, uclear power plants, Return flow, Land manement, Agriculture, Land use, Water cooling, il temperature, Soil moisture, Prototypes, Model dies, Equations, Waste water treatment, Municiwastes.

0.23 acre field prototype of an Agro-Powerste Water complex was utilized to evaluate the sibility of waste heat and water disposal on ricultural land. Municipal waste water was aped to the land by sprinkler irrigation and mained a high soil moisture content and thermal conductivity. Waste heat from power production was dissipated by circulating hot water through a pipe network imbedded in the land. Soil temperature, soil thermal conductivity, heat dissipation, degree of waste water treatment, soil surface temperature, and climatic conditions were monitored on the site. Test equations were developed from the data for predicting heat dissipation and surface temperature for use in a system analysis. Results of the analysis indicated that a 1,500 MWe nuclear electric plant would require 4,500 acres of land equipped with 2-inch diameter piping at a depth of 1 ft and spaced 2 ft apart in sandy soil. A nuclear fuel penalty concept was incorporated into a comparison of this system with conventional waste heat disposal systems. A cost analysis of the land disposal system indicated that it was less expensive than dry-cooling towers but more expensive than wet-cooling towers. (Lisk-FRC)
W79-06969

TECHNICAL ASSISTANCE PROJECT, TRINIDAD WASTEWATER TREATMENT FACILITY, TRINIDAD, COLORADO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 451, Price codes: A03 in paper copy, A01 in microfiche. Report, 1972. 39 p, 2 tab, 2 fig, 7 ref.

Descriptors: *Municipal wastes, *Aerobic treatment, *Operations, *Aeration, *Performance, Oxygen requirements, Waste water treatment, Management, Oxygen.

Operation of the Trinidad waste water treatment facility was evaluated; recommendations concerning plant limitations were made. Major limitations were the lack of an adequate oxygen supply to the aeration basins and aerobic digester, and lack of adequate aerobic digester sludge detention time. The quantity of oxygen supplied was determined to be only half of that required for optimum performance of the aeration basins and aerobic digester. The aerobic digester was determined to be only one-third of the required size at the present plant flow of 1 mgd. Other limitations are described. Recommendations include reconstruction or alteration of the influent channel to provide operators with a dry work area for repairs, a minimum of 70 mg/liter/hr of oxygen be supplied to the mixed liquor in the aeration basins and to the sludge in the aerobic digester, and the minimum detention time in the aerobic digester should be 25 days. (Small-FRC)
W79-06970

LAND TREATMENT OF WASTEWATER IN SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, B. D. Knezek, R. J. Kunz, and I. F. Schneider.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 125, Price codes: A09 in paper copy, A01 in microfiche. Report 1973. 226 p, 1 fig, 81 tab, 16 ref.

Descriptors: *Municipal wastes, *Waste water treatment, *Irrigable land, *Land use, *Application methods, Drainage, Percolation, Soils, Crops.

Data were assembled and interpreted in order to develop irrigation zones for waste water utilization by land application as an alternative effluent treatment method for Detroit. The principal crops that can be grown under irrigation include corn, navy and soybeans, wheat, alfalfa-brome hay, and to a lesser extent, sugar beets. Problems which may be encountered include percolation rate problems and drainage problems in fine-textured soils. For problem soils, 12.5 inches of water per acre is the maximum that can be applied. This application would be scheduled to offset the moisture deficit during the summer months. Application rates on sandy soils will be limited by phosphorus adsorbing capacity. If the phosphorus content is 7 ppm, the application rate sould be limited to 40 inches per year. The total application of water in the 25 counties of Southeastern Michigan is approximately 68 million acre inches per year. More than one-third of the potentially available area would have to be developed to treat Detroit area waste water. (Small-FRC)
W79-06971

EFFECTS OF FLOW EQUALIZATION ON THE OPERATION AND PERFORMANCE OF AN ACTIVATED SLUDGE PLANT,
Ypsilanti Township, MI.
G. W. Foess, J. G. Meenahan, and D. Blough.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 657, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-138, 1977. 95 p, 8 fig, 17 tab, 20 ref, 1 append.

Descriptors: *Pilot plants, *Activated sludge, *Flow characteristics, *Performance, *Costs, Biochemical oxygen demand, Suspended solids, Municipal wastes, Waste water treatment, Nitrogen, Phosphorus, Capital costs.

A pilot plant program evaluated the impact of flow equalization on the 14,000 cu m/day (3.7 mgd) upgraded activated sludge plant of Ypsilanti Township. Process streams were characterized under equalized and unequalized flow conditions with respect to BOD, COD, TSS, and forms of nitrogen and phosphorus. The equalization system functioned in a reliable manner throughout the study and was highly effective in leveling influent diurnal flow variations and providing a uniform daily flow rate to the activated sludge process. Reduction in the variances of BOD, TSS, COD, SOP, TP, and NH3-N across the equalization basin were in the range of about 20 to 80% based on concentration and 45 to 95% based on mass. Some biochemical action occurred in the basin, and there was an increase in suspended solids. BOD removal was marginal and inconsistent. Analysis of secondary effluent indicated that the effects of flow equalization were less important in determining effluent quality than the effects of other operational variables including organic loading intensity, sludge settleability, wind and density currents, recycle rate, sludge blanket height, chemical dose, etc. A cost analysis indicated that the capital costs associated with conversion of existing digesters to equalization basins were about 25% of new construction costs. No power cost economies occurred with flow equalization. (Small-FRC)
W79-06972

TREATMENT AND DISPOSAL OF WASTES PUMPED FROM SEPTIC TANKS,
Storrs Agricultural Experiment Station, CT.
J. J. Kolega, A. W. Dewey, B. J. Cosenza, and R. L. Leonard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 656, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-198, 1977. 151 p, 57 fig, 24 tab, 41 ref, 9 append.

Descriptors: *Septic tanks, *Waste disposal, *Anaerobic digestion, *Aerobic treatment, *Land use, Performance, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Laboratory tests, Pilot plants, Biological treatment, Costs.

Two approaches for treating and disposing of septage were developed and tested in laboratory and pilot plant studies: soil injection and anaerobic-aerobic series processes. These processes can sustain shock loadings and reduce concentrations of BOD, COD, and total Kjeldahl nitrogen by at least 93%. Most of the nitrogen is converted to nitrate. The combined treatment of septage and sewage in a conventional biological treatment plant was considered. The total cost of treating 1000 gal (3785 liters) of septage is about 18 times the cost for treating the same amount of raw waste water in a secondary treatment facility. Operating costs for treating septage in 10 mgd plants are about half the treatment costs in 1 mgd plants or at 1972 prices: $1.80/1000 gal ($0.48/1000 liters) as compared with $3.24/1000 gal ($0.86/1000 liters). (Small-FRC)
W79-06974

EVALUATION OF EXISTING SYSTEMS FOR LAND TREATMENT OF WASTEWATER AT MANTECA, CALIFORNIA, AND QUINCY, WASHINGTON,
Army Terrestrial Sciences Center, Hanover, NH.
I. K. Iskandar, R. P. Murrmann, and D. C. Leggett.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 126, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 34 p, 8 fig, 6 tab, 20 ref, 2 append.

Descriptors: *Waste water treatment, *Ultimate disposal, *Municipal wastes, *Land management, *Evaluation, Application methods, Leachate, Soil chemistry, Phosphorus, Nitrates, Nitrogen, Organic matter, Groundwater, Water quality.

Waste water disposal sites at Manteca, California, and Quincy, Washington, were evaluated for current performance and for the long-term impact of waste water application. These sites have been operated as slow-infiltration, land-disposal systems for up to 20 years. Water quality was used to evaluate current performance, and soil chemical parameters were measured to determine the effects of prolonged waste water application. Differences in pretreatment did not affect current performance. Differences in the performance of the two sites were due primarily to management practices, site history, and climatic differences. Leaching of nitrate was observed at both sites, but the impact on groundwater quality was within acceptable limits (<10 mg/liter of N03-N). Leaching of phosphorus was at both sites to a depth of 150 cm, but it was higher at Manteca. The higher level was due to crop management, land use, and mode and schedule of waste water applications. Total and extractable phosphorus increased in the surface soil levels with time. Soil nitrogen, on the other hand, appeared to decrease, probably due to mineralization. Soil organic matter and cation exchange capacity increased. There was an increase in exchangeable Na, but not enough to produce alkaline or saline conditions. A drop in soil pH after prolonged application was probably due to the removal of carbonates by leaching and by H(+1) from nitrification. Leachate quality, with proper management, should meet proposed EPA guidelines for drinking water. (Small-FRC)
W79-06975

TOC, ATP AND RESPIRATION RATE AS CONTROL PARAMETERS FOR THE ACTIVATED SLUDGE PROCESS,
Hillsboro Sewage Treatment Plant, OR.
C. Ortman, T. Laib, and C. S. Zickefoose.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 615, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-142, 1977. 60 p, 13 fig, 14 tab, 7 ref.

Descriptors: *Industrial wastes, *Activated sludge, *Respiration, *Aeration, *Oxygen demand, Carbon, Organic matter, Operations, Waste water treatment, Computer programs.

The feasibility of using TOC (Total Organic Carbon), ATP (Adenosine Triphosphate), and respiration rates as tools for controlling a complete mix activated sludge plant handling a significant amount of industrial waste, was investigated. A modified F/M ratio was the basis of the control methodology. This ratio was determined by calculating aerator organic loading based on waste water TOC concentration and microorganism concentration and/or activity by TOC and ATP of the activated sludge. Process control decisions were based on 5 to 7 determinations/day. The need for increased or decreased sludge aeration time was determined by respiration rates. Regulatory permit requirements were met when respiration rates were held between 8 to 20 mg O2/gm/hr and other parameters were in an optimum range. A programmable calculator was used to aid in process decisions. Operators could input plant data and instructions for process settings were generated. Functional programs included return rates, mode changes, wasting rates, respiration rate, and corrected settlometer volume. (Small-FRC)
W79-06976

FIELD PROTYPE DEMONSTRATION OF THE SWIRL DEGRITTER,
American Public Works Association, Chicago, IL.
R. H. Sullivan, J. E. Ure, and P. Zielinski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 668, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-60012-77-185, 1977. 64 p, 32 fig, 29 tab, 4 ref, 1 append.

Descriptors: *Waste water treatment, *Separation techniques, *Suspended solids, *Evaluation, *Centrifugation, Costs, Maintenance, Domestic wastes, Storm runoff, Urban runoff.

A 1.8 m diameter swirl degritter designed for a flow of 65.6 liter/sec (1.5 mgd) was evaluated. When tested with sanitary domestic waste water, the swirl unit performed at slightly less efficiency than the conventional aerated grit unit which was operating at less than twice the normal flow-through rate. The characteristics of the grit removal from the swirl degritter were excellent; particles of 0.2 mm diameter were removed. Three Chasick sampling units analyzed grit removal. When blasting sand was added to provide extremely high concentrations of 0.2 mm particles, the unit efficiently removed the particles. The degritter could be used for domestic waste water, combined sewer overflows, or urban stormwater runoff treatment. The lack of moving parts in the basic unit and the unit's small size make it attractive for many applications. An analysis of construction, operating, and maintenance costs for a twenty year life indicated that the swirl degritter is 26 to 38% less costly than the conventional aerated grit chamber. (Small-FRC)
W79-06977

DEVELOPMENT EFFORT TO DESIGN AND DESCRIBE PINK WATER ABATEMENT PROCESSES,
Westgate Research Corp., Los Angeles, CA.
F. C. Farrell, J. D. Zeff, T. C. Grase, and D. T. Boylan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 126, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 63 p, 11 fig, 8 tab, 1 append.

Descriptors: *Industrial wastes, *Waste water treatment, *Ozone, *Ultraviolet radiation, *Pilot plants, *Performance, Design, Capital costs, Operating costs, Annual costs.

A pilot plant test program was carried out to obtain design, operating, and cost information needed to develop a 5000 gpd pilot plant for pink water abatement. A 1000 gpd ULTROX pilot plant (UV-ozone) was used. TNT in tap water equivalent in content to ARRADCOM pink water was used to establish minimum power/residence time operating conditions. Final tests were made on pink water shipped from ARRADCOM. The 5000 gpd pilot plant reactor should have a wet volume of 625 gal and will require up to 37.5 lb of ozone/day and 144, 65 watt UV lamps. There should be a maximum of six reaction stages. Preliminary design drawings have been made of the pilot plant. Overall assembly, reactor assembly, and UV wiring schematic prints are presented along with specifications on standard ozone generators. A program is presented for developing the 5000 gpd pilot plant including the costs involved. Capital costs for a 100,000 gpd ULTRX system to remove 140 ppm TNT and 70 ppm RDX from pink water effluent to <1 ppm TNT and <1 ppm RDX are estimated at $432,000. Annual operating costs are estimated at $87,5000. Total direct cost/1000 gal is $2.50. (Small-FRC)
W79-06978

AN EVALUATION OF THE ENGINEERING DESIGN PARAMETERS OF HYDROGEN PEROXIDE, ULTRAVIOLET OXIDATION OF REFRACTORIES IN WASTE WATER,
Naval Academy, Annapolis, MD.
W. A. Barr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 351 Price codes: A02 in paper copy, A01 in microfiche Report, 1976. 14 p, 5 fig, 1 tab.

Descriptors: *Industrial wastes, *Waste water treatment, *Oxidation, *Ultraviolet radiation, *Performance, Design, Reflectance, Energy, Acids.

Design data were determined for the application of ultraviolet hydrogen peroxide treatment to waste water. Tests with acetic acid indicated that the most difficult refractories in waste water can be oxidized completely with hydrogen peroxide in the presence of ultraviolet radiation. The design of the oxidizing chambers can minimize the treatment time or the energy required per unit volume of the reactants. In an investigation of the ultraviolet radiation reflectivity of the reactor chamber walls using aluminum surfaces and galvanized steel, the reflectivity did not affect the rate at which the oxidation occurred. Design data are needed on equipment to oxidize refractories other than acetic acid. (Small-FRC)
W79-06979

DES MOINES 208 AREAWIDE WASTE TREATMENT MANAGEMENT PLAN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 305 Price codes: A14 in paper copy, A01 in microfiche Report 1977. 88 p, 9 fig, 15 tab, 41 ref, 4 append

Descriptors: *Municipal wastes,*Waste water treatment, *Sludge disposal, *Sewage treatment *Sewerage, Combined sewers, Infiltration, Filtration, Aeration, Urban runoff, Agricultural runoff, Water quality, Land use, Environmental effects

A plan is proposed for the Des Moines Metropolitan Area waste treatment which includes nonstructural and structural programs for the control of point, intermittent point, and nonpoint sources. Point source actions include the construction of a waste water collection system with minimum infiltration and construction of a new sewage treatment plant with an activated biofilter unit and supplemental aeration. Dewatered anarobic sludge will be applied to agricultural land or disposed at the Metropolitan landfill. Intermittent point source controls include segregation of combined sewers and the installation of flow separators at selected combined and storm sewer discharge points. Nonpoint source controls include reducing pollution from cropland runoff, construction sites, and unincorporated areas. The proposed plan will significantly improve water quality and will eliminate water quality violations under wet and dry weather conditions. Adverse impacts include fugitive dust emission, noise, disturbance of vegetation and wildlife, and disruption of land use during construction. During operation of the treatment facilities, the generation of sludge is the major adverse impact. Alternatives include alternate methods of waste water treatment, alternate sludge disposal and treatment methods, and alternate subplans for minimizing point, intermittent point, and nonpoint pollution sources. (Small-FRC)
W79-06981

ACTINOMYCETES OF SEWAGE-TREATMENT PLANTS,
Rutgers - The State Univ., Piscataway, NJ. Waksman Inst. of Microbiology.
H. A. Lechevalier, M. P. Lechevalier, and P. E. Wyszkowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 589 Price codes: A05 in paper copy, A01 in microfiche Report EPA-600/2-77-145, 1977. 89 p, 6 fig, 15 tab 5 ref.

Descriptors: *Actinomycetes, *Activated sludge *Anaerobic digestion, *Foaming, *Sewage treatment, Sewage bacteria, Toxicity, Settling basins Aeration, Foam separation.

Methods of controlling actinomycetic foaming in the secondary aeration and settling tanks of four

ivated sludge sewage treatment plants were luated. The formation of Nocardia-rich foam in secondary aeration tanks is considered a health zard due to the formation of Nocardia-contain- aerosols as well as a cause of reduced treatment ciency and increased labor. The supernatant m anaerobic digesters, previously thought to ntain suspended solids that were toxic to Nocar-, was not toxic for all bacteria. The study at- npted to control foaming in four sewage treat- nt plants equipped with anaerobic digesters by urning supernatant from the digesters to the mary treatment system. Nocardia presence was ermined visually and by gas chromatography ection of nocardomycolic acid in the suspended ids. The results of the studies indicated that cardia-infected foams should be discharged to anaerobic digester and nocardiotoxic material uld be added to the activated sludge reactor. A dy of the chemical nature of the nocardiotoxic npounds was also recommended. (Lisk-FRC)
'9-06982

DUSTRIAL PROCESS PROFILES FOR EN-RONMENTAL USE: CHAPTER 7. ORGANIC ES AND PIGMENTS INDUSTRY,
dian Corp., Austin, TX.
r primary bibliographic entry see Field 5B.
'9-06985

DUSTRIAL PROCESS PROFILES FOR EN-RONMENTAL USE: CHAPTER 10. PLAS-CS AND RESINS INDUSTRY,
dian Corp., Austin, TX.
r primary bibliographic entry see Field 5B.
'9-06986

DUSTRIAL PROCESS PROFILES FOR EN-RONMENTAL USE: CHAPTER 26. TITAN-M INDUSTRY,
dian Corp., Austin, TX.
r primary bibliographic entry see Field 5B.
'9-06987

ROGENIC ACTIVITY OF CARBON-FIL-RED WATERS,
xas A and M Univ., College Station.
W. Wolf, B. J. Camp, and S. J. Hawkins.
ailable from the National Technical Information vice, Springfield, VA 22161 as PB-293 172, ce codes: A06 in paper copy, A01 in microfiche. port EPA-600/1-79-009, 1979. 112 p, 14 fig, 20 , 11 ref, 4 append.

scriptors: *Activated carbon, *Filtration, *Per-mance, *Waste water treatment, *Water purifi-ion, Potable water, Activated sludge, Coli-ms, Microorganisms, Toxicity, Carbon, Organic tter, Correlation analysis, Public health.

e endotoxin content and pyrogenic response of nular activated carbon (GAC) filtered waters re studied. GAC-filtered secondary effluent m an activated sludge pilot plant contained free lotoxins in the range 6-250 micrograms/liter lding positive pyrogenic responses in 18 of 20 ls. Samples were obtained from 27 different plies that utilize GAC adsorption and were nd to contain free endotoxin ranging from 1.2- micrograms/liter, but none gave a pyrogenic ponse. No relationship was found between en-oxin content and pyrogenic response. GAC ls which had been in operation in water treat-nt plants without regeneration for as long as 110 nths, removed small amounts of total organic bon (TOC). Of these, however, 5 of 28 samples wed an increase in TOC through GAC and 8 of samples showed an increase in standard plate nt. None of the 28 contained coliforms, but one 25 yielded pseudomonads. Good correlations re observed on non-disinfected AWT effluent mples between standard plate count and total lotoxin (r=0.945), standard plate count and free lotoxin (r=0.932), and total coliforms and free lotoxin (r=0.939). Good correlations were not erved in assaying AWT samples that had been ject to the disinfecting procedures of chlorima-n, ozonation, pH or UV irradiation. Thus, pyro-genicity was demonstrated for AWT effluents but not for GAC-processed drinking waters. (Small-FRC)
W79-06991

ELECTRODIALYSIS FOR CLOSED LOOP CONTROL OF CYANIDE RINSE WATERS,
International Hydronics Corp., Princeton, NJ.
G. W. Bodamer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 688, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-77-161, 1977. 34 p, 5 fig, 10 tab.

Descriptors: *Industrial wastes, *Electrodialysis, *Metallurgy, *Recycling, *Performance, Salts, Anions, Waste water treatment.

Full-scale trails were conducted of electrodialysis of brass plating rinse solutions. The system was designed to deplete dissolved salts in the rinse waters, yielding water suitable for re-cycle to the rinsing operations and returning the salts to the plating bath. Zero discharge would be achieved. The system was only about one-fourth as effective as had been expected. Earlier work successfully used electrodialysis to treat sodium copper cyanide rinse water. The inefficiency appeared to be due to a reduction in perm-selectivity of the anion membranes as a result of retention of an insoluble zinc compound or of a tightly absorbed zinc complex anion. No remedy could be found for the situation which did not affect the chemistry of the plating bath. Small-scale, preliminary tests are recommended for future applications of this promising technique. (Small-FRC)
W79-06993

FULL-SCALE OPERATION OF A SINGLE-STAGE NITRIFICATION-DENITRIFICATION PLANT,
Owego Town, NY.
D. E. Schwinn, D. F. Storrier, and D. G. Thorne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 728, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-088, 1977. 73 p, 14 fig, 13 tab, 12 ref.

Descriptors: *Municipal wastes, *Waste water treatment, *Nitrification, *Denitrification, *Performance, Design, On-site testing, Aeration, Biochemical oxygen demand, Suspended solids, Costs.

A single-stage nitrification-denitrification process was operated full-scale to determine process feasibility and reliability, necessary design features, and operating techniques to ensure optimum performance. The test plant was selected because waste water temperatures ranged from 8 to 22C, and nitrification-denitrification can be difficult to operate under extremely cold waste water temperatures. Alternating aerobic-anoxic conditions were achieved in completely mixed reactors by the on-off cycling of mechanical aerators. Nitrogen removals from 76 to 86% were accomplished with hydraulic retention times of 13 to 27 hr. BOD and suspended solids reductions were above 90%. Nitrogen removal was reduced to 67% for a 2-3 week period in the summer because of excessive solids inventory but was restored by reducing solids inventory. Thus, nitrogen removal can be achieved in many existing plants at little or no capital cost by implementing single-stage nitrification-denitrification if the design conditions and waste water characteristics are favorable. (Small-FRC)
W79-06994

PRETREATMENT AND SUBSTRATE EVALUATION FOR THE ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTES,
Army Natick Research and Development Command, MA. Food Sciences Lab.
L. A. Spano, T. H. Tassinari, C. F. Macy, and E. D. Black.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 104, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/7-77-038, 1977. 41 p, 11 fig, 6 tab, 64 ref, 2 append.

Descriptors: *Pulp and paper industry, Industrial wastes, *Sludge treatment, *Cellulose, *Performance, Wood wastes, *Hydrolysis, *Enzymes, Ammonia, Laboratory tests, Solid wastes.

The applicability of various treatment methods and existing cellulosic wastes to a process for the conversion of cellulose to glucose and other reducing sugars, was investigated. Pulp and paper mill primary sludge waste was evaluated, and the following four pretreatments were investigated: modified hydropulping, two-roll milling, attritor milling, and anhydrous liquid ammonia. Attritor milling significantly increased the susceptibility of newspaper, cotton, and wood chips was effective in enhancing susceptibility to enzymatic hydrolysis. This was accomplished using 3, 6, and 10 inch diameter mills. Data indicate that large-scale mills using short processing times and high loadings may be possible. Anhydrous liquid ammonia treatment of cellulosic materials offers the potential of a chemical process in which the pretreating agent can be recycled. Materials originating from hardwood sources are more amenable to ammonia treatment than those from softwoods. Two-roll milling followed by treatment with anhydrous liquid ammonia is a possibility. Optimum equipment design, energy requirements, processing techniques, and other system variables require extensive investigation. (Small-FRC)
W79-06995

PLANT EVALUATION AT FISHING BRIDGE WASTEWATER TREATMENT PLANT, YELLOWSTONE NATIONAL PARK,
Environmental Protection Agency, Denver, CO. Region VIII.
O. K. Boe, and L. Malloy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 177, Price codes: A03 in paper copy, A01 in microfiche. Report, 1977. 26 p, 8 fig, 3 tab.

Descriptors: *Waste water treatment, *Municipal wastes, *Personnel, *Seasonal, *Performance, Design, Training, Denitrification, Toxicity.

Operations evaluations were conducted at the Fishing Bridge waste water treatment facility, and deficiencies were noted. The plant design is described. Problems were identified with process control. Generally, the plant operators were seasonal employees, and training in plant operations was seen as necessary. Also, emphasis on detailed daily logs of operation conditions and trend charts, was stressed for future operation. There were some problems with denitrification. After additional training of personnel, the oxidation ditch effluent BOD and total suspended solids level were expected to improve. Toxic substances were to be eliminated from the sewer system. If problems continue with denitrification, surface skimmers may need to be installed on the final clarifier. (Small-FRC)
W79-06997

REMOVAL AND RECOVERY OF SULFIDE FROM TANNERY WASTEWATER,
The Blueside Co., Inc., St. Joseph, MO.
R. H. Sayers, and R. J. Langlais.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 872, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-031, 1977. 129 p, 18 fig, 29 tab, 20 append. 4 append.

Descriptors: *Tannery wastes, *Sulfides, *Adsorption, *Costs, *Recycling, Acids, Hydrogen ion concentration, Coagulation, Proteins, Settling basins, Waste water treatment, Industrial wastes.

A full-scale sulfide reclamation plant was constructed to investigate the feasibility of removing and recovering the sulfides in cattlehide tannery waste water. The combined tannery effluent from the soaking, unhairing, bate, pickle, and chrome tanning wastes from the tannery producing 25,000 hides per week, was screened and clarified. The

clarified effluent was pumped continuously to a degasifier in which acidification to a pH of 5.0-5.5 was effected using sulfuric acid. The hydrogen sulfide liberated from the waste water is adsorbed in recirculating caustic soda until a desired sodium sulfide concentration was achieved. The sodium sulfide is reused in the tannery's unhairing process. Using sulfide reclamation, a savings in material and freight costs was realized of approximately $92,052 per year or $84.84 per month per 1000 hides. The acidification of the total tannery waste water also results in the coagulation of the solubilized proteins which could be removed by secondary sedimentation. This would result in a sizeable reduction of the pollution load and the related sewer surcharge. (Small-FRC)
W79-06999

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
For primary bibliographic entry see Field 7B.
W79-07000

5E. Ultimate Disposal Of Wastes

OCEAN DISPERSAL AS AN ULTIMATE DISPOSAL METHOD,
Philadelphia Water Dept., PA. Water Pollution Control Div.
For primary bibliographic entry see Field 5C.
W79-06663

PUTTING SLUDGE TO WORK.
For primary bibliographic entry see Field 5D.
W79-06805

IMPACT OF NITRILOTRIACETIC ACID (NTA) ON AN ACTIVATED SLUDGE PLANT - A FIELD STUDY,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
N. Wei, R. Stickney, P. Crescuolo, and B. P. LeClair.
Canada-Ontario Agreement on Great Lakes Water Quality, Ontario Ministry of the Environment, Pollution Control Branch, Toronto, Ontario, Canada, Research Report No. 91, 1979, 37 p, 9 fig, 20 tab, 24 ref. 71-3-3.

Descriptors: *Nitrilotriacetic acid, *Activated sludge, *Phosphorus, *Heavy metals, Sewerage, Treatment facilities, Biochemical oxygen demand, Microorganisms, *Diurnal variation.

A field study on the effects of nitrilotriacetic acid (NTA) on activated sludge was carried out at the Waterdown Water Pollution Control Plant, from January, 1972 to April, 1973. The Waterdown Plant is a conventional activated sludge plant with a design of 1 362 cu. m. per d. The nominal wastewater flow was approximately 45% of design capacity and all homes served by the sewer system were within a mile and a half of the treatment plant. The areas investigated in the study include: degradation of NTA, effect of NTA loading on chemical treatment for phosphorus removal, NTA loading and heavy metal removal in the treatment plant, and effect of NTA loading on treatment plant operation. The NTA was added to the treatment plant in the form of Sunlight Soap (a commercial laundry detergent containing 20 wt % NTA) at two rates to approximate NTA spiking levels of 8 mg per L NTA and 16 mg per L NTA. The background NTA loading in the raw wastewater averaged 2.5 mg per L NTA. Diurnal variation studies of the NTA loading showed peak values of 12 mg per L NTA in the afternoon and minimum values of 0.1 mg per L NTA at night. The raw wastewater had an average BOD5 of 100 mg per L, a suspended solids of 150 mg per L, and a total phosphorus loading of 6.0 mg per L P. Heavy metal levels averaged 0.2 to 0.5 mg per L for zinc, aluminum and iron, and 0.01 to 0.2 mg per L for lead, nickel and copper. The treatment plant efficiency averaged 86% BOD5 and 85% suspended solids removal throughout the study. (WATDOC)
W79-06850

IMPACT OF WASTES FROM A WATER TREATMENT PLANT: EVALUATIVE PROCEDURES AND RESULTS,
Illinois State Water Survey, Urbana.
R. L. Evans, D. H. Schnepper, and T. E. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 040, Price codes: A03 in paper copy, A01 in microfiche. Circular 135, 1979. 39 p, 17 fig, 10 tab, 11 ref, 1 append.

Descriptors: *Water treatment, *Sludge disposal, *Illinois, *On-site investigations, Water quality, Data collections, Water sampling, Analytical techniques, Methodology, Water purification, Evaluation, Streams, Environmental effects, Waste disposal, Waste assimilative capacity, Surface waters, Water properties, Chemical properties, *Pontiac(IL), *Vermilion River(IL).

This report summarized the procedures used and the results obtained in assessing the effects on a stream in Illinois of waste discharges from a water treatment plant that employs the clarification process. The water treatment plant serving Pontiac, Illinois, is located on the bank of the Vermilion River, the source of water for treatment. About 1,000 feet downstream of the plant intake is a dam which forms a pool with a maximum water depth of about 8 feet and width of 140 feet at normal pool stage. Wastes from the plant are discharged into the pool about 120 feet downstream of the water intake. The findings were reported here in 3 sections, i.e., the water treatment plant study, chemical characteristics of the stream, and biological characteristics of the stream. There was also a concluding section. All pertinent data developed during the course of the study were included in the appendix. The experience gained during the course of this work confirms the basic principle that the waters of a stream possess the capability of assimilating waste without significant degradation in water quality for normal usage. This capability is a function of stream geometry, flow, upstream water quality, and the characteristics and magnitude of the waste load. At the sites of water plants treating surface waters in Illinois, these relationships are variable. Because of this variability, an intelligent examination at each site is necessary to permit rational decisions governing the impact of waste on water quality. This study may be useful for such examinations. (Humphreys-ISWS)
W79-06889

SEWAGE SLUDGE ENTRENCHMENT SYSTEM FOR USE BY SMALL MUNICIPALITIES,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Soil Nitrogen Lab.
J. M. Walker, L. Ely, P. Hundemann, N. Frankos, and A. Kaminski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 662, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-018, February 1978. 82 p, 29 fig, 23 tab, 8 ref. EPA-IAG-D4-0510.

Descriptors: *Waste disposal, *Sludge disposal, *Landfills, *Ultimate disposal, *Municipal wastes, Trenches, Sludge treatment, Lime, Heavy metals, Water pollution sources, Land use, Solid wastes, Equipment, Economics, Costs.

A method was developed whereby small municipalities can economically entrench without odor or surface water runoff 3 to 48 tons/day of freshly dewatered sewage sludge containing 15 to 25% solids. The readily available, relatively inexpensive equipment included a tractor equipped with a loader and backhoe and a dump truck or concrete mixer truck; a tractor operator and a truck driver were required. Trenches dug with the backhoe were 60 cm wide, 60 cm deep and 60 cm apart. One hour was required to entrench 12 tons of dewatered sludge. The estimated cost of sludge incorporation excluding land cost but including equipment, personnel, hauling 32 km each way, drainage, monitoring and final land cultivation was less than $15/dewatered ton. For reuse of previously entrenched sites a minimal time lapse of two years is sufficient when the previously entrenched sludge has been satisfactorily dewatered. To reduce the potential for metals moving through soils and becoming available to plants, liming the sludge prior to dewatering and entrenchment is recommended. This method is not appropriate in some prime agricultural land, because of the subsoil brought to the surface and the relatively large amount of heavy metals being applied. Entrenchment is appropriate when sludges cannot be land spread; however, it is a resource-wasteful practice with the potential for polluting groundwater by nitrate nitrogen leaching. (Davison-IPA)
W79-06947

DISPOSAL OF SEWAGE SLUDGE INTO A SANITARY LANDFILL,
R. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 680, Price codes: A20 in paper copy, A01 in microfiche. Report EPA-S-801582, 1974. 417 p, 69 fig, 92 tab, 99 ref, 7 append.

Descriptors: *Ultimate disposal, *Municipal wastes, *Sewage sludge, *Landfills, *Performance, Pilot plants, Leachate, Absorption, Odor, Lysimeters.

The disposal of liquid sewage sludge and septic tank pumping into solid waste at a sanitary landfill was investigated in a three-year demonstration project. Benchscale laboratory studies determined the moisture-absorbing capacity of typical solid wastes. Pilot plant lysimeters were used to investigate the effects of sewage and septic tank sludges on solid waste temperature, decomposition, leachate, settlement, insects, odor, and gas characteristics. Full-scale demonstration landfill operation studies were conducted with up to 100% sludge disposal. The solid waste had sufficient ability to absorb moisture and no runoff was produced. Full-scale sludge disposal was economically feasible and produced no leachate. Benefits included increased landfill compaction, greater density, and reduced blowing litter and dust. Problems with the system included odors following raw sludge or septic tank pumpings disposal and bird foraging. (Small-FRC)
W79-06965

STRONG OXIDANT CONDITIONING OF ALLENTOWN WASTEWATER SLUDGE,
Allentown Urban Observatory, PA.
P. J. Usinowicz, and J. F. Stine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 681, Price codes: A03 in paper copy, A01 in microfiche. Report UO-LCCM-ALL-010, 1977. 39 p, 1 fig, 22 tab, 14 ref, 2 append.

Descriptors: *Sludge treatment, *Dewatering, *Ozone, *Ultimate disposal, *Oxidation, Municipal wastes, Lime, Performance, Costs, Waste water treatment.

Hydrogen peroxide and ozone were evaluated as sludge conditioning agents at the Allentown Wastewater Treatment Plant using anaerobically digested sludge. Combinations of hydrogen peroxide, ferric chloride, and lime were tested. Hydrogen peroxide addition was inconsistent in increasing dewaterability, but lower doses between 200 mg/liter to 500 mg/liter were most effective in sludge dewatering improvement when sludge solids were less concentrated, around 30 g/liter. At sludge solids concentrations around 40 g/liter or more, hydrogen peroxide treatment was not effective; in some cases, it was counterproductive. Effective ozone doses were 25 mg/liter to 100 mg/liter when combined with ferric chloride and lime. Higher doses were ineffective. The use of these strong oxidants increased soluble filtrate strength; however, effective conditioning under any chemical application increased soluble filtrate strength. Both oxidants could be applied sucessfully to Al-

own Wastewater Treatment Plant sludge. Suc-
s, however, depends on sludge solids concentra-
s being low (around 30 g/liter). An economic
lysis indicated that hydrogen peroxide doses
e not economically competitive even when
d in combinations with ferric chloride and lime.
ne was competitive. (Small-FRC)
9-06996

**NICIPAL SLUDGE MANAGEMENT ENVI-
NMENTAL FACTORS.**
ailable from the National Technical Information
vice, Springfield, VA 22161 as PB-277 622,
e codes: A08 in paper copy, A01 in microfiche.
ort EPA-430/9-77-004, 1977. 149 p, 2 fig, 14
6 ref, 10 append.

scriptors: *Sludge disposal, *Landfills, *Envi-
mental engineering, *Land use, *Agriculture,
plication methods, Incineration, Oceans, Munic-
wastes, Monitoring.

vironmental factors to be considered by admin-
ators when evaluating grant applications for
struction of publicly owned treatment works
discussed. This information on sludge manage-
nt options can be of use to designers, municipal
ineers, and others. Land application alterna-
s are emphasized because no EPA guidance has
n issued on this subject. The general require-
nts for land application of sludges are discussed
uding stabilization, pathogen reduction, appli-
on methods and rates, and monitoring. Addi-
al requirements for sludge application to agri-
ural lands are reviewed including protection of
d products and agricultural lands and monitor-
requirements. Three other sludge disposal
hods are discussed: sanitary landfill, incine-
n, and ocean disposal. (Small-FRC)
9-06998

. Water Treatment and Quality Alteration

**GIONAL SEWERAGE PLANNING BY
XED INTEGER PROGRAMMING,**
rth Carolina Univ. at Chapel Hill. Dept. of
vironmental Sciences and Engineering.
primary bibliographic entry see Field 6A.
9-06542

PARATUS FOR PURIFYING WATER,
hs-Systemtechnik G.m.b.H., Schweinfurt (Ger-
ny, F.R.). (Assignee).
Hengst.
. Patent No 4,119,517, 10 p, 4 fig, 4 ref; Official
zette of the United States Patent Office, Vol
, No 2, p 665, October 10, 1978.

scriptors: *Patents, *Water treatment, *Water
ification, *Water pollution treatment, Elec-
lysis, Oxidation, Organic wastes, Potable water,
ipment, Electric equipment, Gravity flow,
table equipment.

e primary object of this invention is to provide a
-contained purification apparatus capable of re-
ly destroying microorganisms in raw water,
ich is portable, foolproof, and automatic in its
eration. The appratus described is independent
external energy sources although it may use
m where available. The casing of the apparatus
loses a chamber and is formed with two orifices
ced from the chamber in opposite directions but
nected to the chamber to allow gravity flow of
water from one of the orifices, through the
mber, and out of the other orifice. Two elec-
des mounted in the chamber for flow of the
ter between them are conductively connected
an electric battery by circuitry which causes
rent to flow between the electrodes through the
ter when the water and the battery satisfy
per conditions for the functioning of the appa-
us, such conditions being indicated by a sensible
al. A compartment in the casing, sealed from
electrode chamber, encloses almost all the cir-
try and the battery. (Sinha-OEIS)
9-06621

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
J. Miller.
U.S. Patent No. 4,119,518, 12 p, 8 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 975, no 2, p 665, October 10, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water pollution treatment, Disinfection, Electrolysis, Electrodes, Equipment, Cleaning.

An electrolytic cell for the treatment of water comprises a closed container with a lower inlet opening and an upper outlet opening for the water and at least two electrodes which are adapted to be connected with the positive and negative poles of a DC source. In the interior of the electrolytic cell particles are located whose density is higher than that of water and which are prevented by gratings from emerging from the electrolytic cell. The gratings are arranged in front of the lower water inlet opening and the upper water outlet opening. The openings are smaller than the diameter of the particles. The electrolytic cell particles whose density is higher than that of the water are caused to eddy by the inflowing water. Owing to impingement and friction of the individual particles on the electrodes the eddying brings about mechanical cleaning of the electrodes and improves the electrical conductivity of the water to be treated. (Sinha-OEIS)
W79-06622

WATER PURIFICATION DEVICE,
Lever Bros Co., NY. (Assignee).
B. H. Bory, and A. B. Kessler.
U.S. Patent No 4,133,754, 13 p, 4 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 978, No 2, p 613, January 9, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water pollution treatment, Activated carbon, Inhibitors, Filtration, Domestic water, Equipment.

A device for the purification of water and methods for its use are disclosed. The device is made of a closed, porous, non-woven fabric container containing granular activated carbon as the water purification agent where the fine particles of the carbon are prevented from migrating through the container when the device is immersed in water. It was found that certain chemically unrelated substances could be dispersed or mixed in with the granular activated carbon for preventing the fines of carbon from migrating through the porous container when contacted with water. It was also discovered that these inhibitor ingredients or agents would not substantially contribute any adverse flavor of their own to the treated water. These ingredients include certain mildly inhibited amylose-containing starches, wood flour and a substantially pure aluminum lanolate referred to as 'inhibitors' or 'inhibiting agents'. (Sinha-OEIS)
W79-06631

SUBMERGED SETTLER FOR SUSPENDED SOLIDS,
E. S. Posgate.
U.S. Patent No. 4,133,761, 10 p, 7 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 978, no 2, p 615-161, January 9, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Water purification, Turbidity, Settling basins, Suspended solids.

A water treatment plant extracts water from a large open main body of water into a settling enclosure submerged in the main body of water. The settling chamber is isolated from the main body of water by an enclosure wall. Input passages admit water to the settling chamber and output passages convey water from the quiescent body of water to the water treatment plant. Water entering the settling chamber is held in a substantially quiescent state for a period of time sufficient to ensure that the turbidity of water drawn from the quiescent body is substantially constant and unaffected by turbidity conditions in the main body of water. (Sinha-OEIS)
W79-06633

AN AUTOMATIC CHLORINATION SYSTEM FOR ELIMINATING BIOLOGICAL GROWTH IN PUMPING SYSTEMS FOR AUTOMATIC INSTRUMENTATION,
Environmental Monitoring and Support Lab., Cincinnati, OH. Instrumentation Development Branch.
R. P. Lauch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 081, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-010, January 1978. 33 p, 6 fig, 12 tab, 5 ref, 3 append.

Descriptors: *Chlorination, *Water purification, *Automation, *Microorganisms, Water quality control, Water treatment, Water pollution sources, Dissolved oxygen, Chemical reactions, Pipelines.

An investigation was undertaken to determine whether automatic chlorination could eliminate microbial growth or slime in monitor pumping systems. Dissolved oxygen (DO) was the parameter used to determine sample change within the pumping system because it is easily and accurately measured. A decrease in DO results from microbial metabolism; therefore, it must be noted that other less conspicuous parameters may also be changing. The automatic system described periodically chlorinates the lines to remove the slime microbes. It was evaluated during warm and cold weather to determine the optimum quantity and frequency of chlorination. The results of the field tests show that automatic chlorination is effective for eliminating slime from the inner pipeline surfaces of pumping systems for automatic instrumentation. The minimum daily quantity of chlorine required to keep DO change minimal was a gaseouschlorine feed rate of 2 to 2 1/2 lbs/day. DO samples collected across the pumping system 23 hours after the chlorination cycle yielded an average DO-change of zero. The optimum chlorine concentration and frequency of chlorine addition to the system were determined during the summer months when microbial growth was at a maximum. (Davison-IPA)
W79-06789

CHARACTERIZATION OF REUSABLE MUNICIPAL WASTEWATER EFFLUENTS AND CONCENTRATION OF ORGANIC CONSTITUENTS,
Gulf South Research Inst., New Orleans, LA.
J. K. Smith, A. J. Englande, M. M. McKown, and S. C. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 547, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-016, February 1978. 142 p, 18 fig, 62 tab, 10 ref, 1 append. 68-03-2090.

Descriptors: *Effluents, *Tertiary treatment, *Public health, *Water quality, *Potable water, *Water quality standards, *Water reuse, Waste treatment, Organic compounds, Heavy metals, Ammonia, Nitrates, Phenol, Odor, Turbidity, Water analysis, Sampling, Chemical analysis, Biological properties, Physical properties, Chemical properties, Reverse osmosis.

The major objective of this project was to collect organic concentrates from Advanced Wastewater Treatment (AWT) plants to be used in health effects testing. The first stage of concentration utilized a reverse osmosis process; liquid/liquid extraction was used to further concentrate the organics. The following pilot and fully operational AWT plants were selected for evaluation because of availability and because effluent quality exceeded that of secondary treatment systems: Lake Tahoe, Pomona, Escondido, and Orange County in California; Dallas, Texas; and Blue Plains, District of Columbia. In determining how the quality of the effluents from these systems compared with current drinking water regulations, chemical, physi-

cal, and biological analyses were conducted. Although AWT systems were not designed to produce potable water, all were characterized by high quality effluents. Spot samples taken over a six to nine month period indicatd that nitrogen (ammonia and nitrate), phenol, odor, carbon chloroform extract, turbidity, and specific heavy metals in most of the treated effluents exceeded drinking water regulations. (Davison-IPA)
W79-06868

RIDDING GROUNDWATER OF HYDROGEN SULFIDE. PART 2,
Lochrane Engineering Co., Orlando, FL.
T. G. Lochrane.
Water and Sewage Works, April 1979, p 66-70. 2 fig, 9 tab, 1 ref.

Descriptors: *Groundwater, *Water treatment, *Hydrogen sulfide, *Aeration, Chlorination, Optimization, Water analysis, Water sampling.

Optimum aeration for removal of H2S from groundwater depends on how well the system parameters are known. Filtration is considered to most accurate method for determining H2S concentration. The pH level is measured with a pH probe. Two grab samples, aerated and nonaerated, were collected at specific locations to determine treatment effectiveness. Analysis of these samples showed a first-order reaction for H2S removal. Using the calculated reaction rates and contact time for each aerator, a relationship was plotted for the theoretical contact times required at different hydrogen sulfide removals. These contact times formed the basis of a cost analysis between aeration and chlorination. The combined costs at different percentages of H2S removed identified the most cost-effective removal percentage for combined aeration and chlorination treatment methods. Aerator performance can be improved by increasing agitation in the trays, increasing detention time, and adding a weak acid to lower the pH and increase the H2S gas-phase prior to aeration. (Purdin-NWWA)
W79-06870

WATERBORNE DISEASE - CURRENT THREAT,
California Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 5C.
W79-06910

PYROGENIC ACTIVITY OF CARBON-FILTERED WATERS,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5D.
W79-06991

5G. Water Quality Control

SHIPBOARD OILY WATER POLLUTION - A PRACTICAL GUIDE FOR THE OWNER AND DESIGNER,
For primary bibliographic entry see Field 5B.
W79-06524

PROPOSED 7 YEAR WATER SUPPLY PROGRAM, STATE OF VERMONT.
Vermont State Agency of Environmental Conservation, Montpelier. Div. of Environmental Engineering.
For primary bibliographic entry see Field 6D.
W79-06538

SOUTH COASTAL WATER QUALITY MANAGEMENT PLAN, 1975.
Massachusetts Div. of Water Pollution Control, Westborough.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 317, Price codes: A05 in paper copy, A01 in microfiche. Massachusetts Water Resources Commission, Westborough, Publication No. 8402-85-25-9-75-CR, September 1975. 15 fig, 9 tab, 11 ref.

Descriptors: *Regional planning, *River basins, *Resources, *Water quality standards, *Water pollution, *Water pollution abatement, *Massachusetts, *Cape Cod Bay(MA), Water quality, Biochemical oxygen demand, Fecal coliform, Storm runoff, Agricultural runoff, Nonpoint pollution, Stream/segment classification, Abatement programs, Landfills, Discharge permits, Dissolved oxygen, Hydrogen ion concentration.

The South Coastal Planning Area is located southeast of Boston, includes the towns of Kingston, Plymouth, and Plympton, and is specifically concerned with the waters of these towns which drain to Cape Cod Bay. The report describes the legal provisions in setting up a basin under PL 92-500, the existing water quality problems and standards in the south coastal basin, the abatement program, the sources of nonpoint pollution, the assessment of municipal needs, and the relationship of a water quality plan to other regional plans. The basin plan establishes constraints for waste discharges through the determinants of waste load allocations. The abatement program includes a discharge permit program which establishes effluent limitations and schedules for corrective actions. The permits issued in the south coastal area cover the period through July 1, 1977, and the requirements for these permits are presented. Inherent to the goals of the basin plan are the reclassifications of the waters of the South Coastal Basin. The process and specific recommendations are contained in the report, along with an outline of the monitoring program to determine whether these goals are being achieved. The goals of the monitoring program are: (1) to assure that permit conditions are met at all treatment facilities; (2) to assure that required abatement projects result in the desired water quality; and (3) to locate any new or unknown pollution problems in the basin. Priority water quality areas are established for the planning jurisdiction, and each area is assigned a severity ranking. An appendix presents a summary of public participation activities involved in producing the South Coastal Water Quality Management Plan. (Coan-NC)
W79-06543

NITROGEN AND PHOSPHORUS LOSSES IN RUNOFF FROM NO-TILL SOYBEANS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. L. McDowell, M. E. Ryan, K. C. McGregor, and J. D. Greer.
Paper No 78-2508, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 8 p. 10 fig, 4 tab, 18 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water pollution control, *Nitrogen, *Phosphorus, *Soil erosion, Runoff, Nutrients, Water quality control, Soybeans, Mississippi, No-till.

No-till soybeans and corn can be grown on highly erodible loessial soils in north Mississippi with reduced soil and plant nutrient losses. Soil loss in 1973 from no-till soybeans, planted directly through previous crop residues, was only 0.4 metric tons per hectare (t/ha) compared with 29 t/ha from conventional till. Total (solution plus sediment) nitrogen (N) and phosphorus (P) losses from no-till soybeans were only 4.7 and 2.8 kg/ha, respectively, compared with 46.4 and 17.6 kg/ha from conventional till. Where applicable, no-till is a best management practice for reducing potential nonpoint pollution by sediments and plant nutrients in surface runoff from agriculture. (Skogerboe-Colorado State)
W79-06552

BOOMS USED FOR OIL SLICK CONTROL,
National Water Research Inst., Burlington (Ontario).
Y. L. Lau, and J. Moir.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE2, Proceedings Paper 14530, p 369-382, April 1979. 7 fig, 2 tab, 9 ref, 2 append.

Descriptors: *Oil spills, *Water pollution control, *Laboratory tests, Oil, Oil pollution, Oil wastes, Oil-water interfaces, Currents(Water), Froude number, Hydraulics, Rivers, Harbors, Water pollution, Water quality, Barriers, Oil spill booms, Containment, Oil slicks.

Experiments were conducted to determine the conditions for no contaminant of oil by a boom, the oil-water interfacial friction coefficient, and the maximum angle which a boom can be angled to the flow to deflect an oil slick. The criterion that the densimetric Froude number has to be smaller than about 0.5 for containment was verified. In addition, a new criterion was discovered which specifies a minimum boom draught. The local value of the interfacial friction coefficient was evaluated along the slick, using measured slick profiles, and was found to decrease along the length of a slick. The friction coefficient also increased with increasing oil viscosity. Based on the experimental results, an empirical relationship was derived for the maximum angle at which a barrier could be angled to the flow to completely divert an oil slick. (Sims-ISWS)
W79-06589

ALTERATION OF HYDROGEOLOGIC CONDITIONS DURING MINING OF MINERAL DEPOSITS AND WATER-RESOURCE CONSERVATION MEASURES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology (USSR).
V. D. Babushkin, N. N. Van'kova, Z. P. Lebedyanskaya, N. V. Sokulina, and I. I. Plotnikov.
Water Resources, Vol. 4, No. 6, p 845-858, November-December 1977. 6 fig, 4 tab, 5 ref. Translated from Vodnye Resursy, No. 6, p 59-76, November-December 1977.

Descriptors: *Mining, *Groundwater, *Pumping, *Water pollution control, Water pollution, Water pollution sources, Mine water, Acid mine water, Recharge, Subsurface waters, Water levels, Chemicals, Water chemistry, Geology, Hydrogeology, Water resources, *USSR.

A generalization of the observations of phenomena occurring in regions of development of mining operations and exploitation of large subsurface-water intakes showed that under these conditions, complex processes occur which have been studied in various degrees. Intense water withdrawal, accompanied by a change in the conditions of recharge and discharge of subsurface waters, often leads to a change in the chemical composition of the waters being withdrawn and to depletion of the subsurface-water supply. In addition, the formation of deep and extensive cones of depression in the system of aquifers causes consolidation of the entire rock stratum and deformation of the ground surface. On the other hand, the discharge of mine waters being pumped out is often linked with pollution of subsurface waters in the region of the deposits and of waters of surface streams. Two ways of protecting water resources in mining regions were proposed. The first is based on developing criteria of the safe exploitation of subsurface-water intakes in regions of water-lowering and drainage systems at mineral deposits without the use of special protective devices. The second method is based on the use of engineering methods of water resources protection (treatment of mine water, use of the waters withdrawn by wellpoints, construction of a watertight curtain around the deposit or its individual zones). (Sims-ISWS)
W79-06615

SEPARATING DEVICE TO SEPARATE TWO LIQUIDS OF DIFFERENT SPECIFIC GRAVITY,
L. W. C. deJong.
U.S. Patent No. 4,132,651, 4 p, 2 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 239, January 2, 1979.

escriptors: *Patents, *Oil pollution, *Water pol-tion treatment, *Separation techniques, Water ality control, Specific gravity, Equipment, ow.

separating device for separating two liquids of fferent specific gravities such as oil and water nploys a basin and a separator unit which has w ways spaced one above the other formed of perforate, upwardly inclined inverted V-shaped ates for the flow of the liquid of lighter specific avity toward the apex of each plate and upward- in the direction of the length of the plates. The et for the liquid mixture is adjacent the lower tremities of the plates and the outlets for the eaned water and for the lighter liquid separated the separator unit is at the upper extremities of e plates which are near the upper extremities of e wall of the basin. (Sinha-OEIS)
79-06628

LOTTED BAFFLE FOR USE IN SEPARATING IL-WATER MIXTURES,
nevron Research Co., San Francisco, CA. (As-gnee).
K. Anderson, and M. A. Stewart.
S. Patent No. 4,132,652, 4 p, 2 fig, 5 ref; Official azette of the United States Patent Office, Vol 8, no 1, p 239, January 2, 1979.

escriptors: *Patents, *Water pollution treatment, il pollution, *Separation techniques, Water qual- control, Flow, Equipment, Baffles.

n improved baffle section for use in an oil-water paration tank is provided. The baffle section cludes a perpendicular solid portion extending m above the inlet for the oil-water mixture in e tank to a position below the inlet. The perpen-cular solid portion of the baffle section is ar-nged substantially normal to the axis of flow of e oil-water mixture in the tank to divery the flow a downward direction. The baffle section also cludes an inclined slotted portion extending wnward in the direction of flow from the lower ge of the perpendicular solid portion. There are bstantially more slots in the lower part of the clined portion than in the upper part of the clined portion to better assist the separation proc-. (Sinha-OEIS)
79-06629

UBMERGED SETTLER FOR SUSPENDED OLIDS,
r primary bibliographic entry see Field 5F.
79-06633

EVICE FOR RETRIEVING FLOATING POL-UTANTS ON SURFACE WATER,
A. Stupica.
S. Patent No. 4,133,765, 6 p, 7 fig, 6 ref; Official azette of the United States Patent Office, Vol 8, no 2, p 617, January 9, 1979.

escriptors: *Patents, *Water pollution treatment, Vater quality control, *Oil spills, Oil pollution, rriers, Floating, Skimming, Equipment, Oil re-very, Gravity flow.

l spill retrieval apparatus of the type employing loating flexible barrier, has an oil reservoir tank upled with the barrier in such manner that oil is nveyed from the barrier to the tank by gravity w. An oil intake tube interconnecting the barrier d storage tank has an outlet coupled with the nk at an elevation below the water surface, and opposed mouth floatingly supported on the rface of the water in flow communication with e flexible barrier. In preferred forms, the mouth provided with a one-way gate precluding back-w of collected oil, and has an inflatable bladder rmitting selective vertical adjustment of the outh relative to the flexible barrier and tube tlet. One form of the invention contemplated the e of a buoyant skimmer in combination with the ating supported mouth to enhance oil separation calm water operations. (Sinha-OEIS)
79-06634

METHOD FOR LAKE RESTORATION,
Battelle Memorial Inst., Richland, WA. (Assignee).
G. W. Dawson, and B. W. Mercer.
U.S. Patent No 4,134,831, 7 p, 3 fig, 2 tab, 18 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 982, January 16, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Water pollution sources, Mine waste, Ion exchange, Binders, Sediments, Mine tailings, Ocean mining, Lake restoration, Magnetic retrieval.

This invention overcomes the difficulties of prior art underwater mining and water body restoration proposals and provides a new and effective method of removing water-soluble substances from the rainwater run-off of mine tailing piles. The process is especially advantageous as compared to prior in situ methods because the invention can be used to remove pollutants from almost any type of aqueous environment and because such pollutants are removed permanently so they cannot possibly be rereleased to the environment at some future time. Magnetically attractable collection units containing an ion exchange or sorbent media with an affinity for a chosen target substance are distributed in the sediments or tailings. After a period of time has passed sufficient for the particles to bind up the target substances, a magnet drawn through the sediments or across the tailings retrieves the units along with the target substance. In many instances the medium can be regenerated and the units subsequently put back into use. The target substance may subsequently be refined for use or, if no commercial value, disposed of in a suitable manner. (Sinha-OEIS)
W79-06640

TROPICAL DISEASE BILHARZIA AND IRRIGATION SYSTEMS IN PUERTO RICO,
Center for Energy and Environment Research, Caparra Heights (Puerto Rico). Div. of Human Ecology.
W. R. Joblin.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. IR3, p 307-322, September 1978. 5 fig, 8 tab, 20 ref.

Descriptors: *Irrigation, *Public health, *Puerto Rico, *Reservoirs, *Schistosomiasis, Hydroelectric power generation, Agricultural engineering, Tropics, Parasitic disease, Drainage, South Coast System, Water supply, Water quality control, Snail control, Projects.

In many tropical countries, the construction of irrigation and hydroelectric systems has caused outbreaks of the parasitic disease, bilharzia, or of schistosomiasis, which is transmitted to man from a fresh-water snail and caused by the parasitic schistosome. The history of irrigation systems in Puerto Rico shows that transmission occurred in the South Coast System soon after it went into operation. The prevalence of infection in children from Guyama, a town in the irrigated zone, was zero and rose to 25% soon after irrigation began. Other irrigation systems constructed later did not have this problem, apparently because they had better drainage systems and did not have the small night-storage ponds that served as snail habitats and transmission sites in the South Coast System. A snail control program was started in this System in 1954 and the prevalence in children dropped to zero by 1966. (Bell-Graf--Cornell)
W79-06671

PLANNING FOR WATER QUALITY: 1776 TO 1976,
Hydrocomp, Inc., Chicago, IL.
D. L. Hey, and W. H. Waggy.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 121-131, March 1979. 35 ref.

Descriptors: *Water pollution control, *Water quality, History, *Sewage disposal, *Sewage treatment, *Public health, Water resources, Planning, Reclamation, Natural resources.

Sewerage works appeared in America in colonial times. Boston had sewers prior to 1700 and cesspools by 1709. These facilities were designed to dispose of waste. The emphasis in national planning was on development. The natural resources were regarded as inexhaustible and the Nation's waterways were simply convenient disposal sites for the wastes generated by development. A major change in thinking about water quality occurred when the link between sewage pollution and fatal epidemics was established late in the 19th century. Regional water quality planning was initiated to protect water supplies and treat drinking water. Public health continued as the dominant theme in water quality planning until the 1960's when broader concerns about environmental quality came to the fore. Water quality planning today is concerned not only with the protection of human health, but also with the preparation and rehabilitation of aquatic ecosystems. (Bell Graf-Cornell)
W79-06685

MINIMIZING SALT IN DRAIN WATER BY IRRIGATION MANAGEMENT--DESIGN AND INITIAL RESULTS OF ARIZONA FIELD STUDIES,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-06700

MUD, BRINE MAY BE CLASSIFIED HAZARDOUS WASTE,
J. P. Pitts.
Drill Bit, Vol. 28, No. 4, p 23-24, April, 1979.

Descriptors: *Groundwater, *Water pollution control, *Regulations, *Drilling fluids, *Hazards, Oil industry, Brines, Mud, Oil wastes, Classification.

Proposed EPA regulations relating to ground water protection could completely shut down oil exploration of the Permian Basin if drilling muds and production brines are classified as hazardous wastes. The proposed regulations would add considerable delay, expense and paper work to drilling operations. An estimated 677,000 jobs will be in jeopardy if these regulations are approved. The oil industry will challenge the proposed regulations on a number of legalities as well as ask specific and definite exemptions of brines and drilling muds from the rules. (Purdin-NWWA)
W79-06714

ANNOTATED BIBLIOGRAPHY FOR WATER QUALITY MANAGEMENT, FIFTH EDITION.
Environmental Protection Agency, Washington, DC. Water Planning Div.
Fifth Edition April, 1978. 64 p.

Descriptors: *Bibliographies, Abstracts, *Water quality, Water quality act, Return flow, Water management(Applied), Waste water treatment.

This bibliography was prepared by U.S. Environmental Protection Agency to assist those agencies engaged in water quality management planning. The references cited have been selected for their applicability to 208 planning and for their availability. Each reference is followed by a short abstract, and whenever possible, by detailed price and ordering information. (Skogerboe-Colorado State)
W79-06715

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
Journal of the New England Water Works Association, Vol. 95, No. 1, p 36-41, March, 1979. 2 fig.

Descriptors: *Water pollution, *Water wells, *Coliforms, *Gravel packing, Maintenance, Cleaning, Peat, Chlorine, Disinfection, New England.

The scope of the Committee on Ground Water Supplies of the New England Water Works Asso-

ciation includes the following subjects: test well investigations; well construction; pumping tests; operational problems; yields, and water quality problems. A case history of poor well construction which resulted in a contaminated municipal water supply is presented. Coliform bacteria (not fecal) were found in the water soon after a routine maintenance procedure which used surging and plunging. Apparently the surging caused shallow groundwater containing coliform bacteria to flow through a crack in the well seal and down the gravel pack. In order to correct the problem, the source of contamination (a five-foot layer of peat) had to be removed. Chlorine was the injected and after two days the well was pumped to waste. The well was used for six months before it had to be taken out of service due to a recurrence of coliform. Much care and thought must be given to the construction of a gravel packed well before any mechanical or hydraulic methods of cleaning are used. (Purdin-NWWA)
W79-06735

STEADY-STATE DISSOLVED OXYGEN MODEL OF THE WILLAMETTE RIVER, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
S. W. McKenzie, W. G. Hines, D. A. Rickert, and F. A. Rinella.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202. Geological Survey Circular 715-J, 1979. 28 p, 15 fig, 5 tab, 16 ref.

Descriptors: *Model studies, *Dissolved oxygen, *Water pollution, *Rivers, *Low flow, Analytical techniques, Evaluation, Biochemical oxygen demand, Water quality control, Nitrification, Oxygen sag, Reaeration, Flow augmentation, Channel morphology, Water temperature, Oregon, *Willamette River, *Steady-state dissolved-oxygen model.

A steady-state dissolved-oxygen model, which is based on synoptic data collected during the summers of 1973 and 1974, has been formulated and tested for the Willamette River, Oregon. The model employs the accounting scheme of C. J. Velz in conjunction with a conceptually simple Lagrangian reference system. The model was calibrated and verified with separate data sets from the synoptic studies. Verification resulted in excellent agreement of model predictions with measured dissolved-oxygen data. Sensitivity analysis was used to examine the relative importance of the individual self-purification processes and model parameters. The verified model provides a planning and management tool for the critical summer low flow, high temperature conditions of the river. (Woodard-USGS)
W79-06818

LAND DISPOSAL OF SEWAGE SLUDGE VOLUME VI (APRIL 1, 1977 - MARCH 31, 1978)
Guelph Univ. (Ontario).
T. E. Bates, A. Haq, J. W. Ketcheson, and Y. K. Soon.
Canada-Ontario Agreement on Great Lakes Water Quality, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada; Ontario Ministry of the Environment, Pollution Control Branch, Toronto, Ontario, Canada, Research Report No. 90, 1979, 230 p, 143 tab, 1 app. 72-5-17.

Descriptors: *Sewage disposal, *Agricultural watersheds, *Soil contamination, Subsurface waters, Crops, Agricultural runoff, Nutrients, Metals, Precipitation(Atmospheric), Water analysis, Materials, Application methods.

The objective was to determine maximum rates of sewage sludge application which can be used on agricultural soil without contaminating sub-surface water with nitrate nitrogen and surface waters with elements pathogenic to humans and animals, and without reducing the yield or quality of the crops produced. This volume, which covers the period from April 1, 1977 to March 31, 1978, discusses the results from five years of field runoff studies with fall, winter and spring applied fluid sewage sludge on land cropped with grain corn. Nutrients and metals in runoff water were measured. The report also covers the fifth year of field rate and source studies with sludges resultingfrom treatment of sewage with calcium hydroxide, ferric chloride and aluminum sulphate for phosphorus removal. Oneexperiment involved surface sludge applications on a loam soil on which bromegrass was grown, and two experiments involved corn on a loam and a sandy loam. In a greenhouse experiment, six fluid sewage sludges, selected for their high metal content, were applied to a sandy loam soil. In a greenhouse experiment, six fluid sewage sludges, selected for their high metal content, were applied to a sandy loam soil. Eleven crops of ryegrass grown with sludge added before each crop. Half of the treatments received no sludge after the fifth crop. Crop growth and nutrient and metal uptake were studied. (WATDOC)
W79-06849

PHOSPHATE FERTILIZER AND SEWAGE SLUDGE USE ON AGRICULTURAL LAND - THE POTENTIAL FOR CADMIUM UPTAKE BY CROPS,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
M. D. Webber.
Technology Development Report EPS 4-WP-79-2, January 1979, 30 p, 1 fig, 7 tab, 42 ref.

Descriptors: *Phosphates, *Fertilizers, *Sewage sludge, *Land use, *Cadmium, *Heavy metals, Crops, Soil contamination.

Canadian research on cadmium in soils and crops is reviewed and the potential for cadmium uptake by crops grown on soils enriched with phosphate fertilizer and sewage sludge is considered. Evidence indicates that phosphate fertilizer is not a serious hazard to the human food chain, except possibly when cadmium accumulator crops are grown following successive heavy applications of fertilizers with high cadmium concentrations. Sewage sludge use on vegetable crop land appears hazardous because many vegetables accumulate cadmium and would contribute to its excessive buildup in the human body. The Food and Drug Administration calculates that U.S.A. citizens ingest from 70 to 90% of the World Health Organization maximum permissible level of dietary cadmium (70 micro G per person per day), and that any increase should be limited wherever possible. (WATDOC)
W79-06852

LANDFILL CELL DESIGNED FOR HAZARDOUS WASTE DISPOSAL,
Florida State Dept. of Public Works, Jacksonville. Sanitation Div.
A. J. Kinard, and F. P. Tuenge.
Public Works, Vol. 110, No. 5, p 92-94, May, 1979. 1 fig.

Descriptors: *Landfills, *Industrial wastes, *Waste disposal, Hazards, Water pollution control, Regulations, Groundwater, Water table, Dewatering, Bentonite, Leachate, Monitoring, Sampling.

Due to more stringent requirements of newly instituted rules and standards of the Florida Department of Environmental Regulation, the Jacksonville Department of Public Works designed a landfill which could safely handle disposal of special and hazardous wastes. One cell within the landfill was designated for this purpose. Because of a shallow water table, each fill area is dewatered by a system of perimeter ditches which depress the water table at least five feet below the cell floor. Surface runoff is diverted from the cell and directed into the dewatering ditch. Bentonite was used to seal the cell against possible leachate escaping into the groundwater of percolation of ground water into the cell. A 12-inch top coat of earth was applied to provide mechanical protection. When the cell is filled it will be covered with an impermeable barrier of natural clay to minimize infiltration. Monitoring of the area around the landfill was accomplished with six groundwater sampling wells and five surface water sampling points. Samples are analyzed quarterly for pH, iron, conductance, temperature, and COD. Annual tests are made for cadmium, chromium, copper, lead, total coliform, and pesticides. Samples indicate total containment of the leachate within the cell. (Purdin-NWWA)
W79-06863

RIDDING GROUNDWATER OF HYDROGEN SULFIDE. PART 2,
Lochrane Engineering Co., Orlando, FL.
For primary bibliographic entry see Field 5F.
W79-06870

THE HEALTH EFFECTS OF GROUND WATER RECHARGE: PART II,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 5, p 38-39, May, 1979.

Descriptors: *Groundwater, *Public health, *Artificial recharge, *Water purification, *Waste water treatment, Sewage treatment, Disinfection, Oxidation lagoons, Biodegradation, Water spreading, Groundwater recharge, Soil disposal fields, Soil physical properties, Absorption, Adsorption, Contact time, Injection wells.

Depending on its quality, method of recharge, and intended reuse, water may undergo primary, secondary, or advanced treatment processes. Primary treatment mechanically removes solids from water. Secondary treatment removes dissolved or colloidal materials using biological systems. Advanced Wastewater Treatment (AWT) extracts heavy metals or toxic substances through physical or chemical means. After AWT, chlorine or ozone disinfection rids water of bacteria and virus still present. Storing effluent in open reservoirs is another way to destroy bacteria and viruses which may remain in treated water. Water spreading, an inexpensive and popular recharge method, uses soil systems to filter out bacteria, virus and other contaminants. Basic criteria used in selecting a recharge site include soil texture, water-transmitting capability, and effects of soil constituents on water. Most biodegradation takes place in the upper 24 to 30 inches of soil. Chemicals are further reduced through absorption by plants in the upper 4 to 5 feet of soil. Chemical adsorption removes pollutants until the soil's total adsorptive capacity is reached. Without adequate contact time for the occurrence of necessary chemical and biological reactions there will be little or no attenuation of pollutants. Contact time is reduced by coarse-textured soil, fractures, and pumping. (See also W79-06895) (Purdin-NWWA)
W79-06896

THE ORGANIC DRILLING FLUID CONTROVERSY: PART II,
For primary bibliographic entry see Field 8A.
W79-06898

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--SENSE,
Environmental Resources Management, Inc., West Chester, PA.
R. A. Landon.
Ground Water, Vol. 17, No. 2, p 159-161, March-April, 1979.

Descriptors: *Controlled degradation zones, *Degradation(Decomposition), *Aquifers, *Waste disposal, Waste assimilation capacity, Water pollution control, Groundwater, Regulation, Land use, Zoning, Attenuation, Leachate, Aquifer characteristics, Water quality, Classification.

Controlled degradation is a sound technical alternative to inflexible water pollution control regulations. Aquifers differ in characteristics and quality and this should be taken into account for more discriminative waste management practices. Numerous studies have shown that leachate can be

afely assimilated into the environment by various orms of attenuation, such as precipitation, adsorp- ion-desorption, and dilution. Permeability, the ontrolling factor in leachate assimilation, should ot be so low as to result in a concentrated buildup f leachate, or so rapid as to result in rapid and xtensive migration of leachates. Waste disposal oning is a concept which uses hydrogeologic fac- ors in designating waste areas in areas of intense and use or waste aquifers in regions where natural r man-made ground water quality is already al- ered. There is a need for waste segregation based n a practical classification scheme. Wastes classi- ied as truly hazardous and toxic should be dis- osed of safely. Land disposal operators must be roperly trained and certified to avoid operational rrors. The attitude of regulatory and legal person- el must become more open and flexible with egard to waste disposal and controlled degrada- ion for select wastes. (Purdin-NWWA)
V79-06901

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--NONSENSE,
cience and Education Administration, Phoenix, AZ. Water Conservation Lab.
I. Bouwer.
Ground Water, Vol. 17, No. 2, p 162-164, March-April, 1979.

Descriptors: *Controlled degradation zones, *Irrigation effects, *Water reuse, *Waste water disposal, Protection, Groundwater, Aquifers, Water quality, Deep percolation.

Controlled degradation' of ground water is, never- heless, degradation. The following examples pres- nt ground water quality management alternatives o controlled degradation zones. As total dissolved alts and nitrate concentrations in irrigated lands ncreases the quality of ground water deteriorates. his can be reduced by more efficient irrigation ractices. Another potential threat to ground ater quality is land application of waste waters hich is expected to increase dramatically in the ear future. Renovated water may be of much etter quality than the effluent water but is not as ood as the native ground water due to the pres- nce of nitrogen, metals, and trace organics. En- roachment of renovated effluent water upon ative ground water can be controlled by a system f wells or drains or by pretreatment of sewage ffluent before it is applied to land. Where degra- ation of ground water is inevitable the aquifers ould then be used to receive, store, and renovate aste water. Whether an aquifer should be pro- ected or abandoned depends on economic and nvironmental considerations. (Purdin-NWWA)
V79-06902

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--THE WAY IT LOOKS,
eraghty and Miller, Inc., Port Washington, NY.
. W. Miller.
round Water, Vol. 17, No. 2, p 156-158, March- pril, 1979. 2 ref.

Descriptors: *Controlled degradation zones, Water pollution control, *Aquifers, *Pollution batement, Groundwater, Regulation, Protection, conomic feasibility, Land use, Zoning, Monitor- g, Attenuation, Waste disposal, egradation(Decomposition).

reation of controlled degradation zones requires pplication of special regulatory alternatives to eas where contamination of ground water has ready occurred or is expected to occur. Protec- on zones are areas which have not been adversely ffected by pollution and have strict regulatory ntrols. Controlled degradation and/or protec- on zones are attractive because the technology of round water pollution abatement and containment imperfect and expensive. Controlled degradation quires a large enough buffer zone around the aste disposal site to provide some attentuation of ntaminants, and adequate monitoring to provide rly warning of impending problems. Where the ality of an aquifer has been extensively degrad- , it is rarely technically and economically feasi- ble to rehabilitate it to its natural state. It would be better to condemn wells penetrating the affected aquifer or treat the ground water at the well head. A uniform set of environmental controls cannot be applied as a general solution to all ground water pollution problems. It is too late and too costly to undo many past mistakes. However, with sufficient foresight and creativity, high quality aquifers can be protected with strict land-use controls and advanced engineering design. (Purdin-NWWA)
W79-06903

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION--WHAT IS WRONG AND WHAT CAN BE DONE ABOUT IT,
K. D. Schmidt.
Ground Water, Vol. 17, No. 2, p 148-153, March-April, 1979. 7 ref.

Descriptors: *Planning, *Water pollution control, *Groundwater, Administrative agencies, Regulation, Hydrogeology, Professional personnel, Education, Training.

Deficiencies in the 208 planning approach and possible remedies are discussed. These deficiencies include: overemphasis on protection of surface water quality at the expense of ground water quality; failure to recognize problems indigenous to arid lands; ambiguous definitions of 'point and non-point sources' of ground water pollution; inadequate specifications for the type and degree of waste treatment; a serious lack of qualified ground water geologists and hydrologists in regulatory and planning agencies; too much attention on formulating control measures and not enough on problem definition, monitoring, and data collection; lack of training in ground water quality for those ground water professionals involved in 208 programs. Solutions to these problems include placement of more ground water professionals in local, State and Federal regulatory agencies. Provisions are needed in the 208 approach to insure that ground water professionals are involved. The public should be educated on a long-term basis about ground water and pollution. Academic training in ground water needs to be expanded and ground water quality elevated to the same level as ground water quantity. Finally, registration or certification in the field of ground water hydrology is urgently needed. (Purdin-NWWA)
W79-06904

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Springfield.
D. Wallace.
Ground Water, Vol. 17, No. 2, p 142-147, March-April, 1979.

Descriptors: *Planning, *Protection, *Groundwater, *Water management(Applied), Water pollution control, State government.

As pollutants accumulate on land, the potential for ground water pollution increases, and ground water management planning becomes more significant. The 208 programs may provide the states with the means to involve the public in planning and determining practical solutions to ground water pollution problems. Needs and obstacles in establishing a 208 program for groundwater planning in Illinois are discussed. The present approach of remedial action for major cases of pollution provides a reasonable degree of protection in terms of control, but there is not a high degree of planning for the management of future ground water quality and quantity in Illinois. The 208 approach addresses three new requirements for plans prepared with Federal funding: (1) plans must have continual public involvement, (2) alternatives must include the definition of mechanisms for implementation, and (3) plans must be updated annually to reflect the results of each year's progress. Planning programs under 208 are usually regional in scope rather than site-specific. The preparation of a '5-Year Strategy' for each State under the Water Quality Management Planning programs, public involvement, and the USEPA's new emphasis on aquifer protection as a priority issue will provide the mechanism for funding ground water planning under 208 programs. (Purdin-NWWA)
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
M. Hurd.
Ground Water, Vol. 17, No. 2, p 136-140, March-April, 1979.

Descriptors: *Water pollution control, *Water law, *Administrative agencies, Groundwater, Planning, Regulation, Governments, Programs, Water management(Applied).

Section 208 of the Clean Water Act will integrate economic, fiscal, social, and political factors affecting water pollution control into State and areawide plans and provide state and local governments with means to develop and enforce point, non-point, and ground water pollution control. 208 agencies will educate local elected officials, operating agency personnel, and the general public concerning local and regional problems and solutions. Eventually, they will play a role in the sole source aquifer designation and management process, and the siting and regulation of pits, ponds, lagoons, sanitary landfills and waste treatment facilities. Examples of successful 208 planning agencies are: Nassau-Suffolk Regional Planning Board (NY); Old Colony Planning Council (MA); and Ventura County Regional Sanitation District (CA). These agencies have used funds to identify problems such as salt-water intrusion and contamination from storm runoff. Through ground water studies, each assessed the extent of the problems and used their analysis to produce protection and control recommendations. Integration of 208 with other Clean Water Act programs as well as with programs established under the Safe Drinking Water Act and the Resource Conservation and Recovery Act are now being explored as a means of increasing water quality management efficiency and capability. (Purdin-NWWA)
W79-06906

ELECTRO-OSMOSIS IN GROUND WATER POLLUTION CONTROL,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. C. Bruch, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 377, Price codes: A00 in paper copy, A01 in microfiche. Technical Completion Report, September, 1976. 80 p, 11 fig, 64 ref.

Descriptors: *Electro-osmosis, *Water quality control, *Groundwater movement, Finite element analysis, Aquifers, Confined water, Upconing, Seepage, Dispersion, Flow control.

A numerical model is presented to evaluate the feasibility of using electro-osmosis as a tool in ground water pollution control in aquifers of low permeability. The finite element method is applied to three types of ground water flow problems: movement of ground water in a confined aquifer; prevention of upconing during pumping; and movement of pollutants in a two-dimensional steady seepage flowfield which may have any arbitrary shape. No electro-osmosis was included in the seepage flowfield so that the seepage and dispersion could be treated as uncoupled. The electro-osmosis effect was shown to change the flowfield pattern in a confined aquifer and consequently, the movement of a pollutant in such a flowfield. The electrokinetic phenomenon also reduced the effects of water coning while pumping gas from a gas-water reservoir. (Purdin-NWWA)
W79-06913

DEVELOPMENT OF A MODIFIED TRACER TECHNIQUE FOR MEASURING THE STREAM REAERATION RATE,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. M. Kwasnik, and T. S. Feng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 317, Price codes: A05 in paper copy, A01 in microfiche. University of Massachusetts Water Resources Research Center Publication No. 102, 1979. 68 p, 16 fig, 6 tab, 35 ref, 2 append. OWRT-A-088-MASS (1), 14-34-0001-8023.

Descriptors: *Reaeration, Rhodamine, *Tracers, *Analytical Technique, Biochemical Oxygen Demand, Chemical Oxygen Demand, Critical Flow, Dissolved Oxygen, Gas Chromotography Fluorescence, Fluorescent Dye, Ethylene.

The stream reaeration rate, K2, is a key factor in the calculation of allowable waste levels from point sources of pollution. Past attempts to produce a reliable, accurate and easy to apply method for its measurement have produced a variety of empirical equations that fail to work on river reaches significantly different from those for which the equations were developed. The modified tracer technique of K2 measurement, originally developed by Rathbun, was investigated. The technique uses a hydrocarbon tracer, ethylene, and a conservative tracer, Rhodamine-WT dye. Laboratory experiments determined the parameters essential to the successful field use of the technique. Initial field testing was begun in June, 1977 on a channelized section of the Mill River in Northampton, Mass. Two runs were conducted to verify the reproducibility and precision of the technique. Additional tests were run on the North River in Colrain, Massachusetts. The results of the field testing indicate that the modified tracer technique is a precise and accurate means of directly measuring the reaeration rate, K2. From results of preliminary laboratory experiments, it is recommended that additional laboratory testing be undertaken in regard to pollutional effects. (Godfrey-Mass)
W79-06915

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STOCHASTIC ANALYSIS FOR WATER QUALITY,
Utah Water Research Lab., Logan.
F. Malone, S. Bowles, J. Grenney, and P. Windham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 392, Price codes: A06 in paper copy, A01 in microfiche. Publication UWRL/Q-79/01, March 1979. 75 p, 10 fig, 14 tab, 2 append. OWRT A-039-UTAH (2), 14-34-0001-8047.

Descriptors: *Stochastic processes, *Linear programming, Water quality, Monte Carlo method, Phosphorus loading, Colorado River, Lake Washington.

This report demonstrates the feasibility of applying stochastic techniques to linear water quality models. The Monte Carlo, First Order, and Generation of Moment Equation techniques are applied to a long term phosphorus model of Lake Washington. The effect of uncertainty of the phosphorus loading term on simulated phosphorus levels is analyzed. All three stochastic techniques produced the same results. The simulated concentrations of phosphorus in the water column are very responsive to uncertainty in annual phosphorus loading, the sediment concentration relatively insensitive. The Monte Carlo technique requires the most computation time of the three stochastic techniques applied. The First Order and Generation of Moment Equation techniques are precise and efficient methods of stochastic analysis. In this application they required less than one thousandth the computation time of the Monte Carlo technique. The Generation of Moment Equations technique is also applied to a steady state salinity model of the Colorado River system. Two sources of uncertainty are considered: (1) the estimation of 'steady state' values of salinity loading from a limited historic data base and (2) the estimation of salinity loading from irrigated land by a semi-empirical approach. Six stochastic simulations of the Colorado River system are presented. Coefficients of variations of simulated salinities at Imperial Dam vary from 5.7 to 10.3 percent. The major source of uncertainty in all simulations is the estimation of the steady state salinity loading with the agricultural loading term becoming important in some simulated management alternatives.
W79-06501

MULTIPLE WATER SUPPLY APPROACH FOR URBAN WATER MANAGEMENT,
Weston Environmental Consultants-Designers, West Chester, PA.
A. K. Deb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 768, Price codes: A07 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Applied Science and Research Applications (ASRA), March 20, 1978. 118 p, 28 fig, 22 tab, 61 ref. ENV7618499.

Descriptors: *Water quality, *Water supply, *Water quality planning, *Water supply development, *Water demand, *Water management(Applied), *Models, Waste water, Drinking water, Water treatment, Water quality control, Recycling, Water distribution(Applied), Nonpotable water, Potable water.

The report describes a systems model developed to help planners and engineers to decide whether the multiple supply approach to urban water management is beneficial in long-term planning of water resources. Three grades of water were considered in developing the model: potable (from protected or unprotected sources, treated to highest quality for ingestion); subpotable (of questionable quality in terms of chemicals, but bacteriologically safe); and nonpotable (reuse of wastewater effluent for industrial, agricultural, and urban irrigation uses). Assuming that a municipal system should not employ recycled water for potable uses, separate, dual or multiple supply systems would have to be set up to provide recycled water for subpotable and nonpotable uses. Collection and analysis of water demand data included a detailed survey of water utilities serving populations of 20,000, 100,000 and 500,000 from all parts of the country. Urban water demand categories used were residential (interior and exterior), commercial, industrial, public, and unaccounted for uses. Water quality and treatment requirements for dual or multiple water supply systems, and sources of supply, are presented. The quality of potable water is regulated by the Safe Drinking Water Act of 1974 (P.L. 93-523). Cost functions of 36 unit processes were developed and incorporated into the model. The model was applied to several hypothetical single, dual and multiple water supply systems to illustrate its applicability. The model is very flexible and can handle a conventional system, a dual or multiple system including reuse, or a regional system with up to 10 cities. (Arnold-NC)
W79-06537

MARINE ECOSYSTEM MODELLING IN THE MEDITERRANEAN.
Nature and Resources, Vol 13, No 4, p 7-16, October-December, 1977.

Descriptors: *Ecosystems, *Ecology, *Mathematical models, *Marine biology, *Southern Levantine Coastal Model, *Mediterranean, Ecological distribution, Food chains, Marine microorganism's nutrients, Mathematics, Computer programming data collection, Chemical reactions, Models, Sensitivity analysis simulation.

This paper models ecological relationships and changes in the Mediterranean area. The major events causing ecological changes in the area were the opening of the Suez Canal, the construction of the Aswan High Dam, dumping of urban wastes, overfishing, and spillage of oil from tankers. The purpose of modelling is to represent nature in some abstract language as accurately and manageably as possible. This paper offers a tentative classification of appropriate models for the Mediterranean: (1) large-scale ecosystem models dealing with general relationships in the Mediterranean; (2) meso-scale and small-scale ecosystem models dealing with semi-enclosed bays and smaller marine systems; (3) process or linked-process models to describe processes such as eutrophication or toxicity; and (4) pathway models to deal with the transfer of selected metals and hydrocarbon concentrations within the main components of Mediterranean ecosystems. The principles and procedures of ecosystem modelling are outlined and the steps involved in the process are discussed. These consist of: ecosystem conceptualization; ecosystem mathematization; ecosystem calibration; ecosystem simulation; and ecosystem analysis. The Southern Levantine Coastal Model is described as an example of an ecosystem model with figures showing a generalized coastal system of the Southeastern Mediterranean. Finally data requirements for ecosystem modelling and the need for extensive research in the biological sciences to allow the modelling of problems vital to public concern are discussed. (Coan-NC)
W79-06539

REGIONAL SEWERAGE PLANNING BY MIXED INTEGER PROGRAMMING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. T. Lauria.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 066, Price codes: A04 in paper copy, A01 in microfiche. Sponsored by Applied Science and Research Applications, National Science Foundation, Washington, D.C., Report No. NSF-RA-E-75-203, 1975. 52 p, 6 fig, 7 tab, 3 append. GI37475.

Descriptors: *Regional planning, *Wastewater treatment, *Sewerage, *Upper Neshaminy Creek Basin(PA), *Computer models, Sewage treatment, Pumping plants, Interceptor sewers, Linear programming, Mathematics, Data processing, Cost functions, Force mains, Gravity sewers, Mixed integer programming, Computer programs.

This report presents a mixed integer programming (MIP) model for determining the location, timing, and scale of regional wastewater treatment plants, sewers, and pumping stations. There are certain economies of scale in regional wastewater treatment plants, but the problem of planning these facilities is complicated because of the large number of alternatives involved. A model was sought which would address questions of where, when, and to what scale to build regional plants, gravity sewers, pumping stations, and force mains. The model takes account of existing wastewater facilities and includes operating as well as construction costs. Concave cost equations are approximated by fixed charge functions. The solution strategy for solving the model was developed within the context of branching and bounding techniques. The strategy in this study pursued a variety of methods including disaggregation, upper bounding, priority ordering, and time staging. The model was applied to the Upper Neshaminy Creek Basin, PA, which includes 18 plant sites and 19 sewers. Pertinent data on wastewater inputs at the various nodes are presented. Solution of 9 problems is presented with between 20 and 200 integer variables, 40 to 250 continuous variables, and 60 to 450 constraints. (Coan-NC)
W79-06542

SYSTEMATIC METHODOLOGY TO NUMERICALLY EVALUATE SCENIC FACTORS OF LANDSCAPE: APPLICATION TO TIPPECANOE COUNTY, INDIANA,
Purdue Univ., Lafayette, IN. Dept. of Geosciences.
M. C. Gardner, and W. N. Melhorn.
Available from the National Technical Information

rvice, Springfield, VA 22161 as PB-295 369, ice codes: A10 in paper copy, A01 in microfiche. ater Resources Research Center Purdue Univer- y Technical Report No. 10. March 1979. 195 p, fig, 12 photo, 11 graphs, 2 plates, 1 append. WRT C-6106 5213 (8).

escriptors: *Aesthetics, *Landscaping, Scenery, ity planning, Stream valleys, Lake morphology, kes, Lake stages, Artificial lakes, Eutrophica- n, Geomorphology, Uniqueness ratio, Unique- ss index, LAND, Tippecanoe County(IND).

ty landscapes were delineated in Tippecanoe unty, Indiana on the basis of geomorphic and tural criteria. Measurable physical, biologic and tural parameters which enhance or detract from dscape aesthetics were identified, described, and anged in matrix format. Aerial photographs, ographic maps, land use maps, drainage maps d field observations were used to categorize the nic factors in each landscape. Factor analyses of matrices were employed to identify landscapes h unique scenic attributes. Scenic indices then re developed for the purpose of hierarchially king the scenic qualities of the various land- pes. Nine landscapes of unusual aesthetic value re identified in Tippecanoe County. Five of se are stream valleys whose scenic pleasantness primarily attributable to the natural topographic ersity deriving from erosional processes and the valence of indigenous floral and faunal commu- es. The other four scenic landscapes are upland, erfluvial areas that owe their aesthetic appeal to uite of depositional glacial features and patterns agricultural land use. The major streams and es of Tippecanoe County were evaluated quali- vely and quantitatively in terms of scenic and reational usefulness, and recommendations for ir future use were proposed.
79-06559

ODELS FOR SYSTEM WATER PLANNING TH SPECIAL REFERENCE TO WATER USE,
lorado State Univ., Fort Collins. Dept. of Civil gineering.
W. Hendricks, and H. J. Morel-Seytoux.
ailable from the National Technical Information rvice, Springfield, VA 22161 as PB-294 406, ce codes: A09 in paper copy, A01 in microfiche. lorado Water Resources Institute, Colorado te University, Completion Report No. 90, June 8. 183 p, 40 fig, 17 tab, 15 ref, 2 append. OWRT 15-COLO (4), 14-31-0001-5060.

scriptors: *Water reuse, *Computer models, athematical models, Input-output water balance del, Optimization, Water demand, Water ply, Water resources development, Leontief dels, Statistical models, Water supply develop- nt, South Platte River basin, Cache La Poudre er basin, Colorado.

search to delineate methods for water reuse nning in the context of a complex system with following objectives is reported: (1) to develop matrix format for depicting a complex water tem; (2) to demonstrate the application of the trix format and its application in water planning h reference to water reuse; (3) to develop math- atical programming for a least cost objective ction using non-linear cost functions. A descrip- e model for an overall water system called an ut-output water balance model, and a least cost nputer optimization model were developed ing into account all sources of supply and all tors of demand. Using empirical data from the uth Platte River basin both models are demon- ated. Alternative modes of water development meet overall demands in the South Platte River in to 2020 were delineated by the input-output del. Using the Cache La Poudre as the case ation the model is also demonstrated at the sub- in level. The optimization model used the che La Pourde River basin for the case situa- n. It is concluded that both models can be used ependently, or in a complimentary fashion to luate water reuse in its systems context. (Davi- -IPA)
79-06560

INTEGRATED WATER MANAGEMENT WITH REUSE: A PROGRAMMING APPROACH,
Arizona Univ., Tucson.
D. E. Pingry, and T. L. Shaftel.
Water Resources Research, Vol. 15, No. 1, p 8-14, February 1979. 7 fig, 3 tab, 4 equ, 13 ref.

Descriptors: *Water reuse, *Water delivery, *Economic efficiency, *Nonlinear programming, *Cost minimization, *Water quality, *Flow requirements, Water management(Applied), Equations, Design, Decision making, Optimization, Recycling, Mathematical models, Rivers, Systems analysis, Constraints, Treatment facilities, Transshipment formulation, Economies of scale.

Large quantities of high quality water may no longer be available at low cost in a growing number of regions; this has spurred interest in water reuse and recycling in the derivation of economically feasible water delivery systems increases the complexity of this optimal design problem. Presented herein is a nonlinear programming model which accounts for both flow requirements and water quality, the model containing two different constraint sets. The first set--flow constraints--can be reformulated as a transshipment form of the transportation problem where sources act as supply points (production plants) and disposal areas are demand points (markets). The objective function is to minimize total cost while meeting environmental and legal restrictions. The total cost of delivery and disposal is the sum of the piping cost, the treatment costs, the source costs and the disposal costs. Because of the model's transshipment formulation, the solution technique seems to be effective in aiding the design decisions. (Bell-Cornell)
W79-06673

TWO CENTURIES OF WATER PLANNING METHODOLOGY,
R. K. Linsley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 39-45, March 1979. 13 ref.

Descriptors: *Water resources development, *Water plans, *Planning, *Social impact, *History, *Economic analysis, Water quality, Hydrology, Systems engineering, Environmental impact statement, Projects, Methodology.

The history of water resource planning since 1776 is reviewed with special reference to economic, social, environmental, and hydrologic methodology and applications of systems analysis. The ability of the individual planner stands out as the key factor in successful planning during the period up to about 1920. The chief of the planning team is in a similar position today. Methodology has clearly advanced during the two centuries since 1776 and is now clearly capable of providing an effective base for decision making when all aspects are properly integrated. (Bell Graf-Cornell)
W79-06679

WATER RESOURCES SYSTEMS PLANNING IN U.S.A.: 1776-1976,
Washington Univ., Seattle.
S. J. Burges.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 91-111, March 1979. 54 ref.

Descriptors: *Water resources, *Water plans, *Systems analysis, *Multiple-purpose projects, *History, *Systems management, Irrigation, Flood control, Water supply, Planning, Federal government, Colorado River, Canals, Waterbourne transportation, Western U.S., Agriculture.

Some historical aspects of water resources development and use covering the nation's first 200 years were examined to determine at what points in history the systems method of analysis was used in water resources planning. The systems method was found to apply to cases where clear single objectives directed planning. In situations where the systems view was not taken, less than satisfactory systems resulted. Examples considered include: canals and waterborne transportation, water supply to New York City, the Miami Conservancy District, TVA, and Irrigated Agriculture. The systems approach was followed both in the Miami Conservancy District and TVA within the limits of the analysis techniques available. Areas of potential application of systems analysis tools and techniques in the near-term future (urban water resources management, operation of multipurpose facilities, and water resource allocation) are examined to illustrate the need for the use of systems analysis tools for handling complex constrained systems. (Bell Graf-Cornell)
W79-06683

HYDROLOGY AND WATER RESOURCES PLANNING: 1776-1976,
R. K. Linsley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 113-120, March 1979. 2 equ, 29 ref.

Descriptors: *Water resources development, *Hydrology, *Water plans, *History, *Hydrology, Engineering, Management, Planning.

The development of hydrology as a science and its application to planning and design of water projects is traced from the American Revolution to the bicentennial year. The factors leading to specific advances in hydrology and the mechanisms by which these advances were made are reviewed. Substantial delay between development of new techniques and their application in practice is noted. (Bell Graf-Cornell)
W79-06684

WATER RESOURCES PLANNING AND PUBLIC HEALTH: 1776-1976,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
L. B. Dworsky, and B. B. Berger.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 133-149, March 1979. 33 ref.

Descriptors: *Urbanization, *Water pollution control, *Water resources, *History, *Water plans, *Potable water, Water management(Applied), Water utilization, Urban development, Environmental engineering, United States, Public health.

Planning for water use and management extends from the earliest cultures of agriculture and water navigation to twentieth century energy development. Within this historical framework, the nature of the relationship of water resources and public health provides an important mirror to the character of human civilization over time. In overview terms, this paper describes man's concern for the water environment from historical and scientific perspectives. Early institutions to manage the public health aspects of water resources, the impact of sanitary engineering on urbanization, and the rise of modern environmental engineering in relation to controlling water pollution are considered. Examined is a number of specific elements illustrating the substantial impact that public health interests have had on water resources planning in the United States. Beyond usual drinking water supply and pollution control matters, the paper touches on public safety, insect-borne disease control, institutional change, and issues associated with broad-based multipurpose water resource development planning. (Bell Graf-Cornell)
W79-06686

WESTERN ECONOMIC DEVELOPMENT AND WATER PLANNING: BUREAU OF RECLAMATION,
Utah State Univ., Logan.
J. E. Keith, K. Wilde, J. C. Andersen, and A. LeBaron.
Journal of the Water Resources Planning and Man-

agement Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 161-170, March 1979. 11 ref.

Descriptors: *Water resources development, *Water rights, *Water shortage, *Water allocation(Policy), *History, *Economic development, *Bureau of Reclamation, Municipal water, Recreation, Water plans, Agricultural watersheds.

Reviewed are the early and recent history of the relations between water planning and economic development in the West and Bureau of Reclamation activities. The objectives of Bureau development projects have shifted from the agrarian egalitarian goals of the past to provision of municipal and industrial water and power and recreation and other benefits as the relative benefits to agriculture have declined. The economic efficiency requirements, the environmental movement, and the concommittent comprehensive planning requirements imposed on Federal projects have resulted in the challenge to development which the Bureau currently faces. Bureau supporters come primarily from states that wish to confirm water rights and receive agricultural subsidies in the form of cheap water. The development of vast energy resources and population growth may, however, provide new bases for a resurgence of the engineering solutions of the Bureau to water scarcity and allocation problems in the West. (Bell Graf-Cornell)
W79-06687

PENN STATE RUNOFF MODEL TO PINPOINT FLOOD-PRODUCING SUBAREAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-06730

A DEMONSTRATION OF AREAWIDE WATER RESOURCES PLANNING,
Metropolitan Washington Council of Governments, DC.
C. S. Spooner, J. Promise, and P. H. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 750, Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA-600/5-78-006a, April 1978. 208 p, 31 fig, 19 tab, 130 ref, 4 append. 16110 FEY and 802149, 14-31-0001-3400.

Descriptors: *Water resources, *Planning, *Future planning(Projected), *Systems analysis, *Computer models, Estimating, Forecasting, Decision making, Methodology, Assessment, Water supply, Water quality, Water pollution sources, Data collections, Social aspects, Environmental effects, Economic impact, Resource allocation, Waste treatment, Runoff, Community development, Washington(D.C.).

A study conducted by the Metropolitan Washington Council of Governments resulted in a Framework Resources Planning Model which is a comprehensive analytical tool to be used in areawide water resources management planning. The linked major physical simulation components test alternative future community development patterns by small area, estimate water demands by usage categories, calculate sewage flows based on waters demands and add infiltration/inflow, simulate storm water runoff, test application of alternative waste treatment management systems, and simulate the quality response of the region's major water body. Methodologies for assessing the fiscal, social, and environmental impacts of alternatives are included in the Model's impact assessment portion. The Framework Model, currently used in planning programs, was tested for the Washington Metropolitan region by identifying the cost-effectiveness of six alternative areawide resources management strategies. (Davison-IPA)
W79-06774

REGULATORY WATER QUALITY MONITORING: A SYSTEMS PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. C. Ward.
Water Resources Bulletin, Vol. 15, No. 2, p 369-380, April 1979. 2 fig, 23 ref.

Descriptors: *Water quality, *Monitoring, *Data, Regulation, Legal aspects, Systems analysis.

Regulatory water quality monitoring has evolved to the point where it is a rather complex system encompassing many monitoring purposes and involving many monitoring activities. Lack of a system's perspective of regulatory monitoring hinders the development of effective and efficient monitoring programs to support water quality management. In this paper, the regulatory water quality monitoring system is examined in a total systems context. The purposes of regulatory monitoring are reviewed and categorized according to their legal evolution. The activities of regulatory monitoring are categorized and organized into a system which follows the flow of information through the monitoring program. The monitoring purposes and activities are combined to form a monitoring system matrix--a framework within which the total regulatory water quality monitoring system is defined. The matrix, by defining the regulatory monitoring system and clarifying many interactions within the system, provides a basis upon which a more thorough approach to managing, evaluating, and eventually optimizing regulatory monitoring can be developed. (Bell Graf-Cornell)
W79-06799

TWO-STEP ALGORITHM FOR DESIGN-STAGE LONG-TERM CONTROL OF A MULTI-PURPOSE RESERVOIR,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
S. Simonovic.
Advances in Water Resources, Vol. 2, No. 1, p 47-49, March 1979. 3 fig, 6 ref.

Descriptors: *Multiple-purpose reservoirs, *Long-term planning, *Algorithms, *Stochastic processes, Design, Probability, Computer programs, Optimization, Linear programming, Chance-constrained programming, Equations, Control, Mathematical models, Systems analysis, Iterative convolution, Random variable.

The algorithm presented herein was developed for solving the problem of long-term control or planning for the functioning of a multi-purpose reservoir pool. It is a stochastic problem, involving random parameters in equations by which the control is defined. The complexity of the problem is imposed by the two-step algorithm for solving the long-term optimal control: (1) explication of all chance constraints on the state and control coordinates is being done at the first step; (2) the choice of optimum control is being done in the second step. The method of iterative convolution has been chosen for the first, and the method of linear programming for the second step. (Bell Graf-Cornell)
W79-06810

DISTRIBUTED ROUTING RAINFALL-RUNOFF MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.; National Weather Service, Silver Spring, MD. Hydrologic Sciences Div.; and Geological Survey, Reston, VA. Water Resources Div.
D. R. Dawdy, J. C. Schaake, Jr., and W. M. Alley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 303, Price code: A08 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-90, September 1978. 146 p, 14 fig, 7 tab, 9 ref.

Descriptors: *Urban runoff, *Storm runoff, *Computer models, *Rainfall-runoff relationships, Storm drains, Drainage systems, Channel flow, Flow characteristics, Land use, Soil moisture, Urbanization, Simulation analysis, Analytical techniques, Surface waters, Hydrographs.

A computer program of a watershed model for routing urban flood discharges through a branched system of pipes or natural channels using rainfall as input has been developed and documented. The model combines soil-moisture-accounting and rainfall-excess components developed by Dawdy and others (1972) with the kinematic-wave routing method presented by Leclerc and Schaake (1973). (Woodard-USGS)
W79-06830

WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Preprint 3342, American Society of Civil Engineers (ASCE) Convention and Exposition, Chicago, Ill., October 16-20, 1978. 21 p, 29 fig, 4 ref. OWRT C-7183(6226)(3). 1434-0001-6226.

Descriptors: *Water resources, *Planning, *Computer graphics, *Analytical techniques, River systems, Water quality, Flood control, Regression analysis, Water supply, Linear programming, Simulation analysis, Reservoirs, Multiobjective analysis, Data input, Prediction, Systems analysis.

Presented are computer-aided design methods for water resources planning using interactive computer graphics routines. Four specific types of problems are illustrated: water quality prediction, using simulation and linear programming; flood management, using simulation; reservoir simulation; and multiobjective reservoir-water supply planning which utilizes linear programming. In all cases, tablet digitizing routines have been used for the input of spatial and other data, and vector display methods used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response. (Bell-Graf--Cornell)
W79-06861

ESTIMATION OF WATER SURFACE ELEVATION PROBABILITIES AND ASSOCIATED DAMAGES FOR THE GREAT SALT LAKE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2H.
W79-06894

THE METLAND LANDSCAPE PLANNING PROCESS: COMPOSITE LANDSCAPE ASSESSMENT, ALTERNATIVE PLAN FORMULATION AND PLAN EVALUATION: PART 3 OF THE METROPOLITAN LANDSCAPE PLANNING MODEL,
Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning.
J. G. Fabos, C. M. Greene, and S. A. Joyner, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 308, Price codes: A11 in paper copy, A01 in microfiche. Massachusetts Agricultural Experiment Station Research Bulletin Number 653 September 1978. 229 p, 69 fig, 128 tab, 374 ref, 6 append. OWRT-B-029-MASS(5), 14-31-0001-3897.

Descriptors: Bibliographies, *Land use, *Planning, Assessments, *Landscaping, Urbanization.

A three phase landscape planning framework model is developed, including procedures for landscape assessment, plan formulation, and plan evaluation. Assessment procedures identify, locate, estimate quantity and quality, valuate, and map environmental opportunities and constraints. Plan formulation procedures incorporate information from assessment phase into generation of alternative land use scenarios, which meet specified objective scenarios on landscape values, ecological values, and public service resources. Plan formulation and evaluation procedures are interactively accessed from a remote CRT terminal. Application of planning model to 3 Massachusetts communities showed that one future growth scenario, amounting to a 170 percent increase in urbanized area, could occur with no significant loss or impairment

assessed values. Other growth scenarios inurred significant loss or impairment to assessed alues in excess of 600 million dollars. (Godfrey-lass)
779-06918

PTIMAL WEEKLY RELEASES FROM A SEAONAL RESERVOIR 1. DETERMINISTIC UTURE,
lectro-Watt Engineering Service Ltd., Zurich Switzerland).
or primary bibliographic entry see Field 4A.
779-06919

OMPUTER-BASED PROCESS CONTROL,
aclaren (James F.) Ltd., Willowdale (Ontario).
S. Luscombe.
ournal of the American Water Works Associion, Vol. 71, No. 3, p 127-132, March 1979. 4 fig, ref.

escriptors: *Water resources development, Digital computers, *Plant process control, Costs, enefits, Optimum development plans, Benefit aximization, Feedback software.

he objective of process control is to obtain the aximum cost benefits from a computer based ntrol system. However, during project develop-ent, many things can go wrong, and software sts may drastically increase the total system cost. is therefore important that water system opera-rs, managers, and engineers know how to select e appropriate hardware and software for a com-ter-based system. To decide finally whether or t a particular system should be placed under mputerized control, the capabilities of the com-ter must be evaluated. Presented is a checklist scribing the specific attributes of a real-time ocess control computer system. (Bell Graf-Corll)
779-06927

ASTEWATER TREATMENT CAPACITY EXANSION WITH TIME-VARYING ASSIMILAVE CONSTRAINTS,
RW Systems Group, Redondo Beach, CA.
or primary bibliographic entry see Field 5D.
779-06930

TORAGE MASS-CURVE ANALYSIS IN A SYSEMS-ANALYTIC PERSPECTIVE,
epartment of the Environment, Ottawa (Ontar-). Inland Waters Directorate.
Klemes.
ater Resources Research, Vol. 15, No. 2, p 359-0, April 1979. 6 fig, 1 tab, 61 ref, 1 append.

escriptors: *Reservoir storage, *Reservoir oper-ion, *Model studies, *Dynamic programming, inear programming, *Mass-curve analysis, Opti-ization, Water policy, Economics, Effects, reamflow, Design, Equations, Systems analysis, umerical computation, Shortest path, Stretched-read method, Minimization, Convex loss func-ons.

uring the past decade, the systems approach to orage reservoir problems has been heralded as mething of a jump from the stone age of mass-rve analysis into the modern era of science. In ality, however, no such jump ever occurred; ere were a number of small ones but, contrary to e common belief, many of them were confined to e staircase of mass-curve analysis and not all of em were in the upward direction. This paper tempts to put the mass-curve technique into oper perspective by clearing out some undesira-e semantic underbrush accumulated over the past cades and by showing an intrinsic identity of me mass-curve and systems-analytic formula-ons. It demonstrates that, for the important spe-al case of convex loss functions, both the dynam- and the linear programming formulations of timum reservoir operation policies as developed er the past decade still have a long way to go to atch a 55-year old mass-curve technique in terms exactness and accuracy, as well as computational efficiency. Finally, it shows that the mass-curve technique provides insights into the problems of storage reservoir operation which are entirely out of reach of the systems-analytic methods and can significantly enhance the art of reservoir design and operation. (Bell Graf-Cornell)
W79-06932

WATER QUALITY IN RIVER SYSTEMS: MONTE-CARLO ANALYSIS,
Australian National Univ., Canberra. Centre for Resource and Environmental Studies.
P. Whitehead, and P. Young.
Water Resources Research, Vol. 15, No. 2, p 451-459, April 1979. 9 fig, 2 tab, 25 ref.

Descriptors: *Water quality, *River systems, *Monte Carlo method, *Simulation analysis, *Mathematical models, *Stochastic processes, *Bedford Ouse River(England), *Probability, Forecasting, Downstream, Standards, Effluents, Upstream, Environmental impact, Assessment, Equations, Biochemical oxygen demand, Dissolved oxygen, Aquatic environment, Planning, Statistical methods, Systems analysis, Uncertainty, Sensitivity analysis, Multireach flow, Influents.

Water quality models are described for a 55-km stretch of the Bedford Ouse River in central eastern England. The dynamic models relate time-varying upstream influents to downstream water quality and are stochastic to account for the uncertainty in the system. A stochastic simulation provides forecasts of water quality at a downstream abstraction point in terms of probability distributions, and these are compared with water quality standards, also defined in probabilistic terms. Effluent from the new city of Milton Keynes enters the river at an upstream point, and the impact of the effluent on the aquatic environment is assessed with the sensitivity of the water quality model to parametric uncertainty. (Bell Graf-Cornell)
W79-06935

OPTIMIZATION OF SALINITY CONTROL IN GRAND VALLEY,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker, G. V. Skogerboe, and R. G. Evans.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR1, p 15-28, March 1979. 8 fig, 2 tab, 23 ref.

Descriptors: *Desalination, *Salinity control, *Grand Valley(Col), *Simulation analysis, *Cost-effectiveness, *Optimization, Irrigation efficiency, *Canal linings, Automation, Seepage, Return flow, Drainage, Cost minimization, Structural alternatives, Mathematical models, Systems analysis.

A mathematical simulation of the cost-effectiveness relationship for various agricultural and desalination structural alternatives for reducing salt pickup by irrigation return flows was developed and applied in the Grand Valley of western Colorado. Cost-effectiveness functions developed from the model were then optimized using a least-cost criterion to determine the most cost-effective strategies for salinity control in the valley. The analysis indicates that lining small conveyance channels to reduce seepage and increase the efficiency of the existing furrow irrigation systems should be given the highest priority. Canal lining and desalination of return flows are costly alternatives, but they are feasible when the level of salinity control requires nearly total alleviation of the problem. Some structural alternatives such as field and interceptor drainage exhibited more than an order of magnitude higher costs and should not be considered. (Bell Graf-Cornell)
W79-06936

REDUCING SALT PICKUP FROM IRRIGATED LANDS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 3F.
W79-06937

QUANTITATIVE TECHNIQUES FOR THE ASSESSMENT OF LAKE QUALITY,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 5A.
W79-06938

REGIONAL DEVELOPMENT PLAN EVALUATION: THE USE OF INPUT-OUTPUT ANALYSIS,
Economics, Statistics, and Cooperatives Service, Washington, DC.
R. McKusick, N. Bills, R. Clark, C. Jones, and R. Niehaus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 951, Price codes: A07 in paper copy, A01 in microfiche. Agriculture Handbook No. 530, May 1978. 132 p, 32 tab, 60 ref, 3 append.

Descriptors: *Regional development, *Planning, *Water resources development, *Comprehensive planning, *Input-output analysis, Land resources, Estimated costs, Income analysis, Employment, Economic impact.

The uses and limitations of input-output (I-O) analysis are examined in the plan evaluation process for water and related land resources by the Federal government. Supply and demand relationships of an economy are depicted by an I-O model which also estimates the indirect economic changes which would occur if such a plan were implemented. The appropriate use of I-O models was studied in U.S. Department of Agriculture (USDA) planning efforts; applied examples are presented of I-O multipliers and models which are consistant with the Water Resources Council's 'Principles for Planning Water and Land Resources' and 'Standards for Planning Water and Land Resources'. Economic information needs associated with regional development as were determined and quantitative methods used to develop this information were assessed before I-O multipliers, models and their application were studied. The application correct procedures for using regional I-O techniques is demonstrated in the estimation of secondary market impacts of plans. Evaluating the feasibility of resource plans for a regional economy as opposed to project justification is emphasized. Although this study is specifically oriented to USDA economists formulating and evaluating plans under various USDA resource programs, it is of potential use for regional planning by Federal, State and local planners. (Davison-IPA)
W79-06941

6B. Evaluation Process

PALMETTO BEND DAM AND RESERVOIR: NEED FOR IMPROVED ANALYSIS OF ALTERNATIVES AND COST DATA.
Comptroller General of the United States, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 328, Price codes: A06 in paper copy, A01 in paper copy. December, 1977. 28 p, 4 append.

Descriptors: *Water resources development, *Water supply, *Water demand, *Palmetto Bend Dam(TX), Water storage, Water requirements, Storage capacity, Inflation, Water costs, Cost trends, Recreation, Reservoirs.

The Palmetto Bend Dam and Reservoir Project, in Jackson County, TX, is designed to provide municipal and industrial water, fish and wildlife benefits, and recreational opportunities. The Bureau of Reclamation is responsible for its construction. This study reviews the cost and schedule experience of the project, the potential use of the project, and the selection process which chose this particular project instead of other alternatives. Since authorization in 1968 the project's estimated cost has more than doubled and additional cost growth is anticipated. The scheduled completion date has been delayed until September 1979, over 2 years from the original estimate. Tables and graphs pres-

ent the cost growth by project feature, and an analysis of the reasons for cost growth; an analysis of the Bureau's reasons for cost increases is also presented. The Bureau said inflation accounted for 90% of the cost increase; GAO's analysis indicated inflation accounted for only 60% of the increase. The study determines that two events which justified the project originally have changed. First, the original population projection which was to increase because of urban expansion has been overly optimistic. Second, industrial expansion may be slowed by the water's high price and cost of the distribution system. Several problems with the Bureau's implementation of federal policies and standards for water and water-related land development projects are presented. (Coan-NC)
W79-06535

REGIONAL SEWERAGE PLANNING BY MIXED INTEGER PROGRAMMING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6A.
W79-06542

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W79-06544

IRRIGATION DATA BASE FOR ARIZONA,
Sandia Labs., Albuquerque, NM.
I. J. Hall, and S. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-0968, Price codes: A02 in paper copy, A01 in microfiche. Report No SAND 77-0968, January 1978. 25 p. AT(29-1)-789.

Descriptors: *Irrigation, *Arizona, *Irrigation programs, *Basic data collections, *Solar radiation, Energy, Agriculture, Hydrologic data, Irrigation practices, Irrigation systems, Surface irrigation, Wells, Groundwater, Crops, Evaluation, Pumps.

Data describing irrigated agriculture in Arizona were compiled to provide information to determine regions where solar irrigation is most applicable. Arizona was selected for this preliminary data compilation and analysis, because it is the site of the 150 KWe solar irrigation experiment. Tabulated information on the crops grown, the irrigation wells, and irrigation pumps is provided for the following counties in which irrigated agriculture is significant: Cochise, Graham, Maricopa, Pima, Pinal, and Yuma. (Davison-IPA)
W79-06564

FACTORS AFFECTING WATERWAY INVESTMENT DECISIONS,
G. J. Kelnhofer, Jr.
Water Resources Bulletin, Vol. 14, No. 6, p 1423-1428, December 1978. 12 ref.

Descriptors: *Investment, *Decision making, *Inland waterways, *Navigation, *Effects, Evaluation, Water resources, Costs.

There are many factors, other than economic efficiency, which must be considered in judging the merits of proposed investments in the inland navigation system. No satisfactory formula exists for deciding the net worth of public investments in water resources projects. Such a measure would not be accepted because these investments can serve conflicting goals. Political rather than technical, judgments are required to resolve these goal conflicts. (Bell Graf-Cornell)
W79-06670

WATER PLANNING--OVERVIEW,
E. W. Weber.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 3-7, March 1979.

Descriptors: *Planning, *Water resources, *Cost-benefit analysis, *Legislation, *Water plans, Navigation, Environment, Flood control, Irrigation, Pollution.

The significance of the progression of institutional and procedural techniques in water planning during the past 200 years lies primarily in recognizing that water planning is not merely planning for use of a resource; it is, in effect, planning how to use water wisely to meet the basic needs of people in light of their probable preferences for use of air, water, land, and the environment in general. The lessons learned show the interdependence of water and other resources, the several professional skills needed on planning teams, and the need for displaying alternatives of choice that have the greatest flexibility and probability of satisfying people's needs in the face of continuing change. (Bell Graf-Cornell)
W79-06676

WATER RESOURCES PLANNING--ITS RECENT EVOLUTION,
Clark Univ., Worcester, MA. Dept. of Environmental Affairs.
H. E. Schwarz.
Journal of the Water Resources Planning and Management Division. Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 27-38, March 1979. 1 fig, 15 ref.

Descriptors: *Water resources, *Planning, *Water plans, *Potomac River basin, *NAR study, *Changes, Government agencies, Effects, Economics, Water supply, Water quality, Benefits, Evaluation.

Planning techniques and procedures have changed greatly in the last 20 years. They have changed because: (1) the techniques of analyses have altered; (2) the institutional setting for planning has varied; and (3) society's values have changed. A review of three cases shows these changes and their evolution: the North Branch of the Potomac report (1961); the Potomac River basin report (1963); and the North Atlantic Regional Water Resources Study report (1973). For each case, the techniques and procedures used in Plan Formulation, Plan Evaluation, Objective Setting, and Decision Making are reviewed. The paper concludes that excellent planning is possible and can become probable if institutional development keeps apace with the developing planning methods. (Bell Graf-Cornell)
W79-06678

ECONOMICS AND WATER RESOURCES PLANNING IN AMERICA,
Utah Water Research Lab., Logan.
L. D. James, and J. R. Rogers.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 47-64, March 1979. 66 ref.

Descriptors: Water quality control, *Water plans, *Cost-benefit analysis, *Economics, *History, *Fishing mills, *Social participation, Flood control, Hydroelectric power, Irrigation, Public works, Legislation, Navigation, Natural resources, Projects, Decision making, Design, Programs.

In the United States, the year 1776 marked the beginning of a government dedicated to the development of abundant unclaimed resources for benefit of the common people. It also marked the publication of Wealth of Nations by Adam Smith as the beginning of modern economics. Since then, proponents and opponents of project development schemes for navigation, irrigation, flood control, hydroelectric power, and water quality have seeked economic arguments to support their positions. While economic comparisons have gained widespread application in project design, they have seldom decided project selection. In order to get away from using economics at the project selection level largely to defend decisions already made, economic analysis needs to be restructured by more effective use of the information storage and retrieval capabilities of modern computers so that relevant information from any view point can be quickly provided to people or communities making water management decisions. The goal is to get crusaders to listen to facts before committing themselves and society. (Bell Graf-Cornell)
W79-06680

SOCIAL ASPECTS OF WATER RESOURCES PLANNING,
Miami Univ., Oxford, OH. Inst. of Environmental Science.
G. E. Willeke.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 79-90, March 1979. 18 ref.

Descriptors: *Water resources, *Social aspects, *Planning, *Public works, *Social needs, *Social impact, Dams, Economic analysis, Groundwater, Cannel coal, Levees.

Although social goals have always been considered to some extent in major water programs, treating social concerns in a systematic manner is a recent feature of water planning. This reflects the legal requirements for assessing social impacts, a growing understanding of social systems, and recognition that planning is more effective when social factors are considered. From 1776 to 1925, water management structures were small and there was little Federal involvement. Although planning methodology was meager, social factors were given substantial attention. From 1925 to 1960, an era of building large water management structures, there was a strong belief in the efficacy of structural solutions. From 1960 to the present, evidence has accumulated on adverse effects of projects in such magnitude that planning procedures and goals have been modified to give greater attention to equity and social impacts. Public involvement in planning has been mandated. These developments appear to be leading towards the end of the long separation of the social sciences and engineering. (Bell Graf-Cornell)
W79-06682

ECONOMIC ASSESSMENT OF STORM DRAINAGE PLANNING,
Science and Education Administration, Beltsville, MD. Hydrograph Lab.
W. J. Rawls, and R. H. McCuen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 45-54, November 1978. 8 fig, 15 ref.

Descriptors: *Water management(Applied), *Storm sewers, *Urbanization, *Drainage, *Economic analysis, Planning, Hydrology, Detention reservoirs, Costs, Urban development, Assessment, Economic efficiency, Design, Effects, Metropolitan areas.

Factors that planners must consider in the economic evaluation of storm drainage system alternatives include the scale of development, the degree of protection, and the option for including detention storage. A planning tool that requires a limited data base is presented for use in evaluating various possible designs and the effect on total cost of imperviousness, design return period, and the time of concentration. The utility of the above planning tool is demonstrated for three areas: Washington, D.C.; Dallas, Texas; and Los Angeles, California. Improvement in the efficiency of storm drainage systems will reduce both the total cost and the hydrologic impact of development. Both structural measures--such as detention storage--and nonstructural measures--like open space ponding and grass-lined swales--improve the efficiency of storm drainage systems. The effect on cost of increases in the time-of-concentration is examined as an indicator of the efficiency of storm drainage alternatives. (Bell Graf-Cornell)
W79-06688

CONOMIC ANALYSIS OF STRUCTURAL LOOD PROOFING,
olorado Univ., Boulder. Dept. of Civil, Environental, and Architectural Engineering.
E. Flack.
ournal of the Water Resources Planning and Mangement Division, Proceedings of the American ociety of Civil Engineers, Vol 104, No WR1, p 1-221, November 1978. 2 fig, 4 tab, 5 ref.

escriptors: *Flood control, *Cost-benefit analys, *Floodproofing, *Waterproofing, Flood routg, Urban planning, Structural, Economic analys, Annual, Residential, Commercial, Flood mage.

n economic analysis of flood proofing was apied to a case study of residences and commercial tablishments in the Boulder Creek flood plain of oulder, Col. Two alternate plans (one involving ne and the other four items of flood proofing) ere analyzed in terms of their costs of installation d the benefits derived from reduced flood damges. Data on levels of inundation for floods up to e 100-yr flood were obtained for each structure the flood plain from field surveys. Costs of flood roofing were estimated from standard construcon cost references. Damages were based on andardized flood depth-damage relationships for e structure and its contents. The results indicate at, in general, flood proofing all structures in a ood plain, such as Boulder Creek, is not economilly justified, but that on an individual structure sis some residences and many commercial establhments can be flood proofed at costs less than e benefits derived. (Bell Graf-Cornell)
779-06689

ROUNDWATER LAW,
or primary bibliographic entry see Field 6E.
779-06709

DEMONSTRATION OF AREAWIDE WATER ESOURCES PLANNING,
etropolitan Washington Council of Governents, DC.
or primary bibliographic entry see Field 6A.
779-06774

/ATER RESOURCES POLICY STUDY: /ORKING DRAFTS OF THE TASK FORCE EPORTS,
/ater Resources Council, Washington, DC.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-278 989, rice codes: A14 in paper copy, A01 in microfiche. ovember 11, 1977. 315 p, 13 fig, 10 tab, 6 ref, 5 ppend.

escriptors: *Planning, *Management, *Water reources, *Water resources development, Water nservation, Cost sharing, Federal budget, Costs, nvironmental control, Water rates, Federal reseations, Flow, Flow augmentation, Groundwater, /ater pollution sources, Water quality standards, dministration.

nterim drafts of six task forces which allow the olicy committee to monitor the progress of each sk force are presented. The drafts express issues eing addressed in the policy review and suggest ternative resolutions of each issue. The Task orce on Revision of Water Resource Planning nd Evaluation Criteria and Procedures discusses ve separate issues and their various options. Eight otential options are identified by the Cost Sharing ask Force to promote water conservation and ost sharing, to reduce the impact on the Federal udget, to obtain equitable distribution of costs, nd to assure better environmental protection. The /ater Conservation Task Force addresses the ederal role in a national water conservation proram, water pricing, Federal programs, and total ater management. The Federal Reserved Water ights Task Group presents three basic viewpoints managing the Reserved Rights. Five water qualy issues, instream flows, flow augmentation, roundwater management, non-point sources, and ater quality standards compliance, are determined to be most important by the Water Quality Task Force. The Water Research Policy Task Force's report attempts to develop a national water management process whereby the research needs of the Nation can be met. (Davison-IPA)
W79-06776

MANUAL FOR EVALUATING SECONDARY IMPACTS OF WASTEWATER TREATMENT FACILITIES,
Abt Associates Inc., Cambridge, MA.
M. FitzPatrick, J. Willson, D. Ericson, G. Fax, and D. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 153, Price codes: A09 in paper copy, A01 in microfiche. Report No. EPA-600/5-78-003, April 1977. 184 p, 30 fig, 176 ref. 68-01-3268.

Descriptors: *Waste water treatment, *Treatment facilities, *Publications, *Environmental effects, *Evaluation, *Assessment, Future planning(Projected), Water quality, Surface waters, Groundwater, Economic impact, Wetlands, Wildlife, Habitats, Coasts, Floodplains, Parks, Land use.

Guidelines to aid in assessing the secondary impacts of waste water treatment facility construction are presented. This guide, intended for local officials, EPA Regional staff, and State officials, gives the range of potential secondary impacts, and describes current EPA policy and regulations governing analyses of these impacts. The assessment task is twofold: growth and land use projection, and estimation of environmental impacts resulting from waste water treatment facility induced growth. The 14 areas of secondary impacts covered are categorized into four groups: media impacts, such as ambient noise levels; sensitive environmental area impacts, such as floodplains; unique area impacts, such as parklands; and secondary economic impacts, such as property values. Approaches to refine and improve existing projections of amount, type, and location of projected growth in a service area are described. Application of these approaches is provided for various levels of sophistication, consistent with analysis capability and available resources. Procedure for conducting an initial assessment of the relative seriousness of the 14 types of impacts listed is given. (Davison-IPA)
W79-06777

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 855, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA 903/9-78-015, Chesapeake Research Consortium, Incorporated. Publication No. 61, October 1977. Conference held at the Patuxent Naval Air Test Center, Maryland, (1977) 310 p, 11 fig, 11 tab, 117 ref. ENV-74-24271A03.

Descriptors: *Chesapeake Bay, *Ecology, *Transportation, *Planning ecosystems, Food, Food chains, Wildlife, Water pollution, Oil spills, Toxicity, Water chemistry, Management, Natural resources, Environmental effects, Environment.

A conference was held to discuss the progress achieved in planning and governing the Chesapeake Bay and some of the current major problem areas perceived by local, regional, State and Federal officials. The list of topics highlighted includes: the Chesapeake Bay Study by the Corps of Engineers; the purpose and nature of the EPA Chesapeake Bay Program; a consensus on the condition of the Bay; maritime development; toxic substances; prevention and control of spills; exploration and research in the Bay; fisheries and wildlife; non-point pollution; coordination in Bay management; inter-state alternatives in coordinating Bay management; and State-Federal alternatives in coordinating Bay management. Responses to each presentation are included. (Davison-IPA)
W79-06778

NATURAL RESOURCE INVENTORY CHECKLIST RESEARCH REPORT NO. 50 SECTION 4: WATER RESOURCES.
Montana Agricultural Experiment Station, Bozeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 765, Price codes: A03 in paper copy, A01 in microfiche. Report No NSF-RA-E-74-441, February 1974. 27 p. GI29908X.

Descriptors: *Natural resources, *Water resources, *Surveys, Inspection, Investigation, On-site data collections, Environment, Habitats, Water conservation, Water pollution, Wetlands, Aquatic habitats.

A checklist resulting from a literature review and consultations with natural resource experts is presented. It was designed to stimulate ideas, conversation, and an awareness of the complexity of the environment; to aid in identifying local critical issues; and to select the details needed in natural resource inventories. This water resources section covers the following topics: (1) watershed water budget; (2) chemical water quality; (3) visual and aesthetic examination; (4) macrobiological inventory; (5) biological inventory; (6) physical water quality; (7) soils relations; (8) geology relations; (9) water-air resources relations; (10) water pollution inventory; (11) wetlands area; (12) lakeshore and watercourse frontages; (13) water-animal relations; and (14) water-plant relations. (Davison-IPA)
W79-06780

PRELIMINARY ECONOMIC ANALYSIS OF SOLAR IRRIGATION SYSTEMS (SIS) FOR SELECTED LOCATIONS,
Sandia Labs., Albuquerque, NM. Dept. of Systems Analysis.
L. L. Lukens, A. M. Perino, and S. G. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND 77-1403, Price codes: A03 in paper copy, A01 in microfiche. Report No. SAND 77-1403, November 1977. 49 p, 25 fig, 27 tab. AT (29-1)-789.

Descriptors: *Irrigation systems, *Solar irrigation systems, *Irrigation operation and maintenance, *Economic feasibility, Cost analysis, Comparative costs, Electric power costs, Capital costs, Research and development, Agriculture, Crops, Soil types, Evaluation.

A preliminary analysis of the economic feasibility of stand-along solar irrigation systems for certain applications in various locations is described. The life cycle cost (LCC) of the solar irrigation system was compared to the life cycle cost of conventional systems to determine economic feasibility. The LCC of a stand-alone SIS in southern Arizona is 1.5 to 3 times greater than that of a conventional electric system when based on operation for irrigation only between 1980 and 1990. The SIS becomes competitive when 100% of the system capacity is utilized throughout the year, indicating that solar irrigation can be made feasible if the systems can be incorporated into the farm as a power or heat source rather than an irrigation only energy source. Results of SIS designed for five other areas show that SIS LCC is greater than that of electricity as follows: 2 to 4 times higher in the San Joaquin Valley, California; 3.5 to 6.5 times higher in northwestern Nebraska; 2.5 to 5 times higher in central New Mexico; 4.5 to 9 times higher in southeastern Oregon; and 2 to 4 times higher in the southern High Plains of Texas. A hybrid system, solar power with an electrical backup, was examined for southern Arizona. In this case the hybrid becomes economical by 1990 without government incentives or utilization of the total system capacity during the off-season, indicating that SIS should not necessarily be designed for self-sufficiency. (Davison-IPA)
W79-06781

CHESAPEAKE BAY FUTURE CONDITIONS REPORT VOL. 10, APPENDIX 13: ELECTRIC POWER, APPENDIX 14: NOXIOUS WEEDS,

Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 480, Price codes: A03 in paper copy, A01 in microfiche. (1977) 169 p, 20 fig, 18 tab, 76 ref.

Descriptors: *Chesapeake Bay, *Electric power, *Aquatic plants, *Future planning(Projected), *Aquatic weeds, Electric power demand, Electric power industry, Electric power plants, Submerged plants, Pond weeds, Aquatic weed control, Rooted aquatic plants, Sago pondweed, Herbicides.

The impacts of electrical power on the development of the Chesapeake Bay area are discussed in appendix 13. Historical progress, present developments, and future needs and potentials are presented. Historical patterns of energy consumption were analyzed according to current developments in the power industry within a defined market area and its sectors. Future power demands in the market area were estimated through the year 2020. Land and water use were identified as related to the generating capacity mix required to supply the estimated demand. Generating plants were sited through the year 2000 and associated water use was identified. In appendix 14 the types of problems associated with excessive growths of aquatic plants in the Bay and its tributaries are reported. The various types of aquatic plants and the factors affecting their growth are discussed. Past problems involving noxious weeds in the Bay area are surveyed. Pertinent control measures and the advantages and disadvantages of their use are reviewed. (Davison-IPA)
W79-06794

IRRIGATION PLANNING BASED ON WATER DEFICITS,
Southampton Univ. (England). Inst. of Irrigation Studies.
J. R. Rydzewski, and S. Nairizi.
Water Resources Bulletin, Vol. 15, No. 2, p 316-325, April 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Irrigation, *Projects, *Simulation analysis, *Water deficits, *Underwatering, Planning, Crop yield, Water costs, Cost-benefit analysis, Economic efficiency, Computer models, Effects, Timing, Irrigation water, Water supply, Methodology, Optimization, Systems analysis, Design capacity, Benefit maximization, Equations.

The deliberate underwatering of a larger land area, as practiced in Southern Asia, has provided impetus for systematic investigation into the effects of designing projects for crop water deficits on benefit-cost performance. The study began with the derivation, from published experimental results, of functions relating ultimate crop yield to the magnitude and timing of water deficits, i.e., of the productivity of irrigation water. To obtain the net benefit of the project, the relation between the harvested area and output and the on-farm production costs was then suggested. The cost of supplying the irrigation water to the proposed area and of distributing and applying it to the field was determined, thus completing the benefit-cost equation. A computer simulation model was then established to search for the irrigation project design capacity and area to maximize the net present value in the benefit-cost analysis for the development proposed. In all three cases studied, there appeared good evidence that deliberate underwatering over an extended land area could produce economic (or financial) benefit, this being particularly marked with supplementary irrigation when using mechanized units. (Bell Graf-Cornell)
W79-06797

EVALUATION OF ALTERNATIVES TO THE GARRISON DIVERSION UNIT,
Waterloo Univ. (Ontario). Dept. of Systems Design.
N. M. Znotinas, and K. W. Hipel.
Water Resources Bulletin, Vol. 15, No. 2, p 354-368, April 1979. 9 tab, 15 ref.

Descriptors: *Evaluation, *Multiple-purpose projects, *Water resources development, *Benefits, *Canada, *Garrison Diversion Unit, *Comparison techniques, River basins, Farms, Irrigation, North Dakota, Environmental effects, Decision making, Systems analysis equations, Missouri River, Fuzzy sets, International Joint Commission, Engineering designs, Intagible factors, Qualitative information, Senitivity.

The Garrison Diversion Unit is a multipurpose water resources project which is currently under development for the purpose of diverting water from the Missouri River basin to irrigate farmland in North Dakota. Due to the objections raised by various interest groups, the project has recently been reviewed by the International Joint Commission. This article surveys the background to the project and the various alternatives that have been proposed. By utilizing recently developed fuzzy set techniques, the proposed alternatives are evaluated and a plausible solution is offerred. The study results indicate that it may be advisable to remove the Souris Loop irrigation area from the Garrison project, but the environmental impacts of the study may preclude the implementation of any alternative that can affect Canada. These findings are in partial agreement with the recommendations of the International Joint Commission. (Bell Graf-Cornell)
W79-06798

WILD RIVERS--METHODS FOR EVALUATION,
M. B. Sonnen, and L. C. Davis.
Water Resources Bulletin, Vol 15, No 2, p 404-419, April 1979. 7 fig, 5 tab, 21 ref.

Descriptors: *Wild rivers, *Evaluation, *Methodology, *Benefits, *Water resources economics, *Analytical techniques, Costs, River basins, Environmental effects, Washington, Equations, Recreation, Irrigation, Intangible values, Low development levels, Benefit maximization, Monetary benefits, Nonmonetary benefits.

Two analytical methods are presented and demonstrated for evaluating the monetary and nonmonetary benefits of wild rivers. In the traditional benefit-cost context, special techniques are required to show that any wild river is worthy of preservation. The methods presented allow for the possibility of low development levels in river basins to be optimal, although advanced development can also be shown to be most efficient in some circumstances. That is, the methods are not directed to the wild condition only, but to the entire spectrum of development possibilities. The applications of the methods to two adjacent subbasins in the State of Washington each showed that the currently undeveloped basin should be left in its wild condition, while the partially developed basin next door should be developed even more fully.(Bell Graf-Cornell)
W79-06800

ENERGY ANALYSIS OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 5C.
W79-06802

DESIGN OPTIMIZATION OF HIGH-RATE DISINFECTION USING CHLORINE AND CHLORINE DIOXIDE,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
For primary bibliographic entry see Field 5D.
W79-06803

FUZZY SET APPROACHES TO PLANNING IN THE GRAND RIVER BASIN,
Waterloo Univ. (Ontario). Dept. of Systems Design.
H. Alley, C. P. Bacinello, and K. W. Hipel.
Advances in Water Resources, Vol. 2, No. 1, p 3-12, March 1979. 1 fig, 9 tab, 10 ref.

Descriptors: *Alternative planning, *Decision making, *Grand River basin(Ontario Can), *Cost effectiveness, *Dominance matrix, Water resources, Effects, Design, Data collections, Equations, Systems analysis, *Fuzzy set techniques, Questionnaires, Ranking, Interest groups, Pessimistic aggregation, Mean aggregation, MacDonald analysis.

Fuzzy set approaches are used to analyze alternative solutions to a water resources planning problem in the Grand River basin in Ontario, Canada. The output from questionnaires which were answered by local politicians and other interested parties, provides input data to fuzzy set analyses. The fuzzy set techniques are designed such that non-quantitative and quantitative factors, and the viewpoints of the interest groups, can be readily incorporated into the decision-making process. Ranking of the alternatives is achieved through the use of a dominance matrix which is designed for this purpose. By comparing the ratings of each alternative in the fuzzy set analyses to the cost of the alternative, a comparison is made among the alternatives based upon cost effectiveness. The reasonable results obtained for the Grand River basin application confirm the efficacy of the fuzzy set procedures. (Bell Graf-Cornell)
W79-06809

DEW, FOG AND HYGROSCOPIC FOOD AS A SOURCE OF WATER FOR DESERT ARTHROPODS,
Hebrew Univ., Jerusalem (Israel). Dept. of Entomology.
M. Broza.
Journal of Arid Environments, Vol. 2, No. 1, p 43-49, March 1979, 3 fig, 2 tab, 19 ref.

Descriptors: *Dew, *Fog, *Hygroscopic water, *Invertebrates, *Water balance, Nutrient requirements, Environmental effects, Condensation, Microenvironment, Insect behavior, Moisture stress, Water requirements.

Certain species of desert arthropods are distinguished by their ability to utilize dew and damp hygroscopic material as a source of moisture. The present paper reports the results of field experiments carried out in arid region of Israel to demonstrate how these water sources are exploited by species of isopods, ants, bugs, carabid, coccinellid and several tenebrionid beetles. Numerous investigations of strips of ground in the area were conducted and microclimatological measurements made at the beginning of each observation period. Presented here is a description of one typical night and early morning observation on October 12, 1972 in which two relevent phenomena were observed: (1) direct drinking of dew drops and (2) eating of hygroscopic material which had absorbed water during the night. Observations were carried out immediately after the end of a heat wave and the amount of water gained by tenebrioned beetles following the intake of hygroscopic material was measured and found to be substantial from a summary of data on the occurence of dew and fog in the desert area of Israel, it is concluded that these sources of water could meet the water requirements of many desert arthropods. (Tickes-Arizona)
W79-06834

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
F. H. Dave, and P. J. Schreuder.
Water Resources Bulletin, Vol. 15, No. 2, p 326-336, April, 1979. 4 fig, 10 ref.

Descriptors: *Groundwater, *Water wells, *Wellfields, *Sites, *Environmental effects, Planning, Regional analysis, Florida, Leakance, Water table, Interference.

Potential well-field locations for Hillsborough, Pasco, and Pinellas counties in west-central Florida were determined with a visual selection technique. This technique is based on an understanding of regional hydrology and an appreciation of development goals such as the location of high-yield and low-impact sites. Site-selection criteria include: leakance, depth to water table, depth to nonpotable

ater, change in the potentiometric surface, and ojected well-field interference. Overlays of each iterion are combined to form a regional compos- showing favorable site locations. The actual e-specific values for transmissivity, leakance, orage coefficient, specific capacity, and water ality at the selected locations are determined rough a testing program. This technique, with odifications, can be used in other geographic gions. (Purdin-NWWA)
779-06855

OUR CORNERS REGIONAL STUDY OF UBLIC AND LEGISLATIVE OPINION ON ATER AND OTHER NATURAL RESOURCE OLICIES,
rizona Univ., Tucson. Dept. of Political Science.
. M. Ingram.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-296 094, rice codes: A04 in paper copy, A01 in microfiche. roject Completion Report, May, 1979. 46 p, 17 b. OWRT B-056-ARIZ(1). 14-34-0001-7111.

escriptors: Legislation, Planning, *Water alloca- on, *Water conservation, Public opinion, Poli- es.

his project was concerned with public and legis- tive attitudes about water, energy, environment d other public policy issues. In the area of water source allocation and development our analysis s shown that, despite all the pressures for ange, neither voters nor legislators are willing to k that any particular users cut back in their use of ater. Even irrigated agriculture, which currently es ninety percent of the water in the region, has e support of the vast majority of both voters and gislators to continue to use the same or more ater in the future. This unwillingness to reallo- te water away from agriculture to municipal, dustrial and other uses exists despite the fact that large majority of the people polled feel that ater shortages are a serious problem. We con- ude by suggesting that there will be little change om present water policies if the direction of ture water politics is left to these Western voters d their elected state representatives.
779-06892

RAGMENTATION OF PUBLIC AUTHORITY VER FLOODPLAINS: THE CHARLES RIVER ESPONSE,
lassachusetts Univ., Amherst. Dept. of Geology d Geography.
or primary bibliographic entry see Field 6E.
779-06916

HE METLAND LANDSCAPE PLANNING ROCESS: COMPOSITE LANDSCAPE AS- ESSMENT, ALTERNATIVE PLAN FORMU- ATION AND PLAN EVALUATION: PART 3 F THE METROPOLITAN LANDSCAPE LANNING MODEL,
lassachusetts Univ., Amherst. Dept. of Landscape rchitecture and Regional Planning.
or primary bibliographic entry see Field 6A.
779-06918

HE ROLE OF ECONOMIC MODELS IN VALUATING COMMERCIAL FISHERY RE- OURCES,
laryland Univ., College Park. Bureau of Business nd Economic Research.
. C. Harris, Jr., and V. J. Norton.
merican Journal of Agricultural Economics, Vol.), No. 5, p 1013-1019, December 1978. 1 fig, 2 b, 5 ref.

escriptors: *Fisheries, *Economics, *Regional nalysis, *Mathematical models, Evaluation, Mar- eting, Effects, Decision making, Input-output nalysis, Equations, Systems analysis, National.

his discussion is based upon the recognition that ere are and increasingly will be pressures to evelop regional impact measures for fishery olicy decisions. The issue of conceptual and em- pirical differences between the willingness to pay market value approaches to deriving value esti- mates is bypassed. Instead, the groundwork has been laid for improved regional analysis to fisher- ies decisions. Concern has been indicated with standard input-output models and even with the applicability of dynamic input-output models to regional questions. Also, any model that cannot identify economic activity generated from nonpro- ductive transaction costs will provide misleading implications. It is concluded that the appropriate approach is one based on econometric relationships and which allows for dynamic and simultaneous adjustment in relevant variables and even coeffi- cients. Presented as an example is the Harris Model, indicating how its concept of location rent can be adapted to consider regional fisheries ques- tions. It is believed that given the model, the planned adjustments, and appropriate data, the re- sults can provide an important input into many regional issues. It is necessary to account properly for changes in economic activity before net bene- fits can be derived. (Bell Graf-Cornell)
W79-06926

ANALYSIS OF OPERATIONS AND MAINTE- NANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
For primary bibliographic entry see Field 5D.
W79-06955

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE EFFECT OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTA- TION OF WHEAT,
Virginia Polytechnic Inst. and State Univ., Blacks- burg. Dept. of Agricultural Economics.
J. K. Binkley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 632, Price codes: A13 in paper copy, A01 in microfiche. Ph.D. Dissertation, April, 1977, 288 p, 26 tab, 22 fig, 43 ref, 5 append. OWRT B-082-VA (1).

Descriptors: Mississippi River, Inland waterways, *Transportation, *Wheat, User charges, Transship- ment models.

This study evaluated the effect of inland naviga- tion user charges on barge wheat movements on both the Mississippi River system and particular segments of the system. In order to accomplish these objectives, transshipment models were con- structed, examining three wheat varieties: hard red spring, hard red winter, and soft red winter. The models permitted two types of movements from producing to consuming areas: direct movements or movements through river transshipment points. This allowed the models to choose between barge transportation and competitive modes. Consuming regions were comprised of domestic milling points and foreign countries. Exports to any given point were allowed to move through any of several U.S. ports, depending upon relative transport costs. This gave the models a great deal of flexibility in the export sector, which is critically important for barge transportation of wheat. Data used included 1970-71 wheat production and consumption, and 1975 barge and rail rates, truck costs, and handling costs for each mode. User charges were based on 1974 operation and maintenance costs of the inland waterway system and 1974 barge ton-miles. Base solutions were obtained for each of the models, and then each was run with user charges recover- ing from 25 to 500 percent of annual operation and maintenance. The effects of uniform charges and charges specific to each waterway were examined.
W79-06731

COST ALLOCATION FOR A REGIONAL WASTEWATER TREATMENT SYSTEM,
SRI International, Menlo Park, CA.
For primary bibliographic entry see Field 5D.
W79-06929

SUBSTITUTING FOR WATER INPUTS IN U.S. MANUFACTURING,
Bankers Trust Co., New York.
C. R. Grebenstein, and B. C. Field.
Water Resources Research, Vol. 15, No. 2, p 228- 232, April 1979. 3 tab, 29 ref.

Descriptors: *Water, *United States, *Elasticities of substitution, *Manufacturing sector, Estimating, Capital, Labor, Water prices, Equations, Math- ematical models, Systems analysis, Aggregate pro- duction functions, Trans-log cost function, Water demand.

Partial elasticities of substitution among capital, labor, and water provide evidence concerning the possibilities of adjusting the techniques of manufac- turing to accommodate changing scarcities of water. Empirical estimates of elasticities for the United States are obtained by using a trans-log cost function with SIC two-digit manufacturing data for 1973. Results show that water and labor inputs are good substitutes but that water and capital are complements. Economic implications of this find- ing are discussed. (Bell Graf-Cornell)
W79-06931

OPTIMAL WATER PRICING AND STORAGE WITH CYCLICAL SUPPLY AND DEMAND,
California Univ., Los Angeles. Dept. of Econom- ics.
J. G. Riley, and C. R. Scherer.
Water Resources Research, Vol. 15, No. 2, p 233- 239, April 1979. 1 fig, 19 ref, 1 append.

Descriptors: *Water supply, *Pricing, *Water demand, *Water storage, *Reservoir operation, *Planning, *Optimization, Constraints, Investment, Mathematical models, Systems analysis, Equations, Economic efficiency, Lagrangian analytical frame- work, Storage capacity, Marginal cost, Peak pric- ing.

Optimal storage of a naturally renewable, seasonal- ly varying resource is considered where demand is price sensitive and seasonal and social resources are required for storage and processing prior to consumption. The particular application is water supply, where the demand and supply fluctuations are generally out of phase. Using a Lagrangian analytical framework, net willingness to pay is maximized subject to fundamental constraints that characterize water supply and storage. The pur- pose of this work is to integrate the literatures of peak load pricing and optimal reservoir planning and operation, noting that price is both an active form of 'soft' demand management and an effective information signal for efficient allocation of (non- water) resources in the management of water supply. Results indicate that although demand is assumed to vary continuously with time, the opti- mal rate structure is approximated by a policy in which the price of water is adjusted at only a few points in the cycle. In contrast with the usual discrete time model, the duration of each subper- iod of constant pricing is endogenously deter- mined. It is also shown that owing to the introduc- tion of storage, off-peak prices as well as the peak season price may be held above marginal operating costs, thereby bearing part of the capacity costs. (Bell Graf-Cornell)
W79-06933

6D. Water Demand

ESTIMATION OF RESIDENTIAL WATER DEMAND,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Economics Research Report No 39, October 1977. 73 p.

Descriptors: *Water demand, *Water supply, *Water rates, *Statistical models, Use rates, Least squares method, Correlation analysis, Time series analysis, Econometrics, Regression analysis, Eco- nomics, Peak pricing, Raleigh(NC), Residential water use.

The general purpose of this study is to estimate water demand equations and to analyze whether the policies of peak-load pricing and supply rationing through price adjustment will have an appreciable effect upon water demanded at the household level. The study presents a review of the literature on estimation and projection of water use. The study data are a set of both cross-section and time series meter readings of monthly water use from a sample of residential households in the city of Raleigh, N.C., for the period May 1969 to December 1974. The report discusses the assumptions and applications of the classical least squares model, the covariance model, the random error components model, and the correlated error models. The economic model used in the analysis consists of residential use of water per household as the dependent variable; and average daily rainfall per period, average daily temperature per period, appraised value of house and lot, water price, and size of household as the independent variables. Total residential demand for water is that total quantity of water consumed in a given period for all residential purposes. Other dependent variables include winter demand and sprinkling demand for water. Generally, sprinkling demand was found to be highly responsive to changes in the level of the climatic variables and water price. Household size explained the largest proportion of the variation in the data. The results of this study will aid in evaluating the effect of pricing schemes upon water demand and estimating whether or not such policies should be adopted. (Coan-NC)
W79-06531

MULTIPLE WATER SUPPLY APPROACH FOR URBAN WATER MANAGEMENT,
Weston Environmental Consultants-Designers, West Chester, PA.
For primary bibliographic entry see Field 6A.
W79-06537

PROPOSED 7 YEAR WATER SUPPLY PROGRAM, STATE OF VERMONT.
Vermont State Agency of Environmental Conservation, Montpelier. Div. of Environmental Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 260, Price codes: A05 in paper copy, A01 in microfiche. January 1974, 74 p, 2 fig, 20 tab, 4 append.

Descriptors: *Water resources planning, *Water supply, *Water supply development, *Water utilization, *Water costs, Legislation, Construction costs, Water pollution, Economics, Municipal water, Water quality, Water treatment, Water use, Waste water disposal.

This report evaluates two water supply program changes in Vermont and provides a 7-year projection of costs with a proposal for State assistance for municipal water supply systems. In January 1973 the local assistance federal grant programs for water and sewer system construction funded by the Farmers Home Administration and Dept. of Housing and Urban Development were terminated. These construction grants provided 50% of project costs, with State construction grants of up to 35%. Fifteen communities have been ordered to boil their water, and an additional 71 communities have been ordered to undertake major improvements in their water systems. In addition, 26 communities have been identified as requiring minor improvements. These projects would result in a $75 million construction program; the absence of Federal assistance makes construction of such 'complete projects' economically unfeasible. In the absence of Federal aid, and to help municipalities with public health hazards, those municipalities having the most critical problems are distinguished from the remainder according to the criteria of level of acceptable water quality, extent of covered storage to prevent water contamination, minimum storage capacity to meet demand, and extent of interconnection of system with existing distribution systems. Under these criteria, such 'minimum acceptable project' costs are estimated to be $35,750,000, with the state supplying 70% of the funds. It is recommended that applicable state legislation be amended to award water supply development funds only to municipalities with urgent needs, and that allocation of funds be determined on a dollar amount basis rather than the present percent basis. Proposed legislation is presented. (Arnold-NC)
W79-06538

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W79-06544

SYSTEMATIC METHODOLOGY TO NUMERICALLY EVALUATE SCENIC FACTORS OF LANDSCAPE: APPLICATION TO TIPPECANOE COUNTY, INDIANA,
Purdue Univ., Lafayette, IN. Dept. of Geosciences.
For primary bibliographic entry see Field 6A.
W79-06559

DEMAND PROJECTIONS CONSIDERING CONSERVATION,
M. B. Sonnen, and D. E. Evenson.
Water Resources Bulletin, Vol 15, No 2, p 447-460, April 1979. 8 fig, 6 ref.

Descriptors: *Water conservation, *Water demand, *Forecasting, Hawaii, Water supply, Planning, Prices, Mathematical models, Systems analysis, Equations, Effects, Use patterns, Outdoor demands, Family residences, Rainfall, Elasticity, Land use.

Prediction of future water demands depends on the degree to which conservation effects can be anticipated. A model developed for the Corps of Engineers shows that choosing a numerical conservation target to be achieved is more meaningful and yields more predictable results than price or price elasticity manipulations. The method developed and then applied to the Kaneohe Bay region of Oahu considers the following determinants of demand: geographic distribution of the users, indoor and outdoor requirements, time (by year and month of the year), precipitation, historical unit usage rates, gross and irrigable acreage of land uses, price for water, elasticity of demand with respect to price, source of the water supply (local private supplies vs. agency supplies), and the percentage conservation savings anticipated in each future period in indoor and outdoor uses of water in each of 40 possible land uses. (Bell-Graf Cornell)
W79-06796

WATER RESOURCES OF THE POTOMAC RIVER BASIN, WEST VIRGINIA,
Geological Survey, Morgantown, WV. Water Resources Div.
W. A. Hobba, Jr., E. A. Friel, and J. L. Chisholm.
West Virginia Geological and Economic Survey River Basin Bulletin 3, 1977. 110 p, 48 fig, 3 plates, 30 tab, 56 ref.

Descriptors: *Water resources, *West Virginia, *Potomac River, *Groundwater resources, *Water quality, Available water, Water supply, Water demand, Hydrologic data, Streamflow, Runoff, Low flow, Aquifers, Water wells, Water yield, Floods, Surface-groundwater relationships, Groundwater recharge, Water analysis, Chemical analysis, Planning, Water resources development.

This report presents basic information and interpretations regarding the occurrence, availability, and quality of the water resources of the Potomac River basin in West Virginia. The basin includes an area of 3,464 square miles or about 15 percent of the State. The present population is 125,500. Considerable future increases in population, with increases in recreational and industrial expansion, are anticipated. Thus, a knowledge of the water resources is essential in proper planning for development. Virtually all water in the basin is derived from precipitation. Average annual precipitation is 38 inches per year; of this amount 25 inches is returned to the atmosphere by evapotranspiration, 8 inches becomes ground-water recharge, and 5 inches becomes direct overland runoff. Average annual streamflow is 0.9 cubic feet per second per square mile. The carbonate rocks of Berkeley and Jefferson Counties are the best aquifers and may yield more than 600 gallons per minute to individual wells tapping cavernous zones. The shale rocks of the central part are generally the poorest aquifers. The chemical quality of both surface water and ground water is very poor to excellent, depending on location. (Woodard-USGS)
W79-06813

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF NORTHERN MISSISSIPPI, 1975,
Geological Survey, Jackson, MS. Water Resources Div.
J. A. Callahan.
Mississippi Board of Water Commissioners Bulletin 79-1, 1979. 79 p, 7 fig, 49 tab, 35 ref.

Descriptors: *Water supply, *Surface waters, *Groundwater, *Water quality, *Water utilization, Hydrologic data, Aquifers, Well data, Water levels, Water yield, Water demand, Water analysis, Chemical analysis, Municipal water, Industrial water, *Northern Mississippi.

Public and industrial water withdrawals for the 45 counties of northern Mississippi amounted to more than 520 million gallons per day in 1975. Water usage was divided about equally between groundwater and surface-water sources. Ground-water pumpage for public supplies and self-supplied industry was 78 and 143 million gallons per day, respectively. Rural water use was 12 million gallons per day exclusive of irrigation. Of the total usage, 291 millions gallons per day was from surface-water sources primarily for cooling water. Industrial water is obtained from Lake Ferguson and the Sunflower River. The city of Columbus, pumping from Luxapallila Creek, is the only public supply using surface water; all other public supplies are obtained from wells. Producing aquifers ranged in age from Paleozoic to Holocene. The most widely used aquifers are the Meridian-upper Wilcox and the Sparta Sand, both of Eocene age. The largest withdrawal, over 74 million gallons per day, is made from the Mississippi River Valley alluvial aquifer. (Woodard-USGS)
W79-06827

6E. Water Law and Institutions

PALMETTO BEND DAM AND RESERVOIR: NEED FOR IMPROVED ANALYSIS OF ALTERNATIVES AND COST DATA.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-06535

WATER QUALITY MANAGEMENT PLANNING IS NOT COMPREHENSIVE AND MAY NOT BE EFFECTIVE FOR MANY YEARS.
Comptroller General of the United States, Washington, DC.
U.S. General Accounting Office, Publication No CED-78-167, December 11, 1978. 49 p, 7 append.

Descriptors: *Federal Water Pollution Control Act, *Water quality, *Water quality control, *Regulation, *Water quality standards, *Water management(Administrative), *208 planning, Planning, Water pollution control, Water law, Water pollution, Water resources.

In this report to the House of Representatives, the General Accounting Office (GAO) analyzes the effectiveness of Implementation of the 208 water quality planning program by the U.S. Environmental Protection Agency (EPA) since passage of the 1972 Federal Water Pollution Control Act (P.L. 92-500). Findings indicate that EPA's management of the 208 program has been costly and that more

ffective agency planning with regard to standards etting and funding for state programs is needed. nitial funding for state 208 programs did not occur ntil more than a year after passage of P.L. 92-500, nd after funding EPA did not vigorously follow hrough in seeing that states meet requirements of ection 208 on time, due to inadequate time frames mposed on states in the first place. GAO recom-nends that public participation play a more impor-ant role in the 208 planning process, and that EPA hould reassess the 208 program and report to Congress on how long it will take to get adequate ata on future effective program planning, and vhat planning alternatives to the 208 program are ossible. Greater special interest group involve-ent is also recommended. Oregon's 208 program s cited as a model partly due to that state's effi-ient use of remote sensing and aerial photography ata to determine river basin water quality prob-ems earlier in the stages of its program. (Arnold-NC)
V79-06536

SOUTH COASTAL WATER QUALITY MAN-AGEMENT PLAN, 1975.
Massachusetts Div. of Water Pollution Control, Vestborough.
For primary bibliographic entry see Field 5G.
V79-06543

CENTER PIVOT IRRIGATION IN THE CO-LUMBIA BASIN OF WASHINGTON AND OREGON: DYNAMICS AND IMPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geogra-hy.
K. W. Muckleston, and R. M. Highsmith, Jr.
Water Resources Bulletin, Vol. 14, No. 5, p 1121-128, October 1978. 1 fig, 13 ref.

Descriptors: *Irrigation, *Columbia River Basin, Effects, *Water law, Washington, Oregon, Tech-ology, Investment, Capital, Markets, Thermoelec-ric energy, Institutions, Socioeconomic character-stics, Small towns.

As of 1976, over 225,000 acres were being irrigated by center pivot units in a five-county area of the Columbia Basin in Oregon and Washington. Most of the development occurred since 1970. Dynamic pplication of center pivot technology altered the oncept of irrigability in the study area, converting ands that were often rolling, sandy, and plagued by wind erosion from low grade grazing to pro-luctive irrigated units. This development was en-irely by private enterprise, with large corporate arms accounting for much of the effort. Little rior comprehensive planning or coordination took lace. When the circulation of water is altered on uch a massive scale, however, unplanned impacts nay be far reaching. In this case they include: (1) cceleration of the shift to high cost thermoelectric eneration; (2) alteration of the state institutions esigned to allocate water; and (3) possible signifi-ant alterations of the socio-economic fabric of mall rural service centers. (Bell-Graf--Cornell)
W79-06674

STATE WATER QUALITY CONTROL PRO-GRAM IN ARIZONA,
Arizona State Dept. of Health, Phoenix. Environ-nental Health Service.
R. L. Miller.
Water Resources Bulletin, Vol. 14, No. 6, p 1503-1506, December 1978.

Descriptors: *Water quality conrol, *Programs, *Arizona, *Legislation, Public law, Point source, Nonpoint source, Standards, Areawide planning, Plan review, Facilities inspections, NPDES, En-forcement, Operator certification, Monitoring, Construction grants.

Arizona's water pollution control program is based on authorities of Arizona Revised Statutes and Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. The primary areas of this program are monitoring, facility in-spections, plan review, planning, discharge permits and grants for the construction of publicly owned waste water treatment facilities. The discharge permit program deals with control of point-source discharges and is administered by the United States Environmental Protection Agency. The planning and construction grants programs are administered by the State Water Quality Control Council and are implemented by the Bureau of Water Quality Control, which serves as staff to the Council. There are several challenges that face the State in this program. First is the adaptation of the 'eastern law' to deal with Arizona's water quality prob-lems. Second is to address problems caused by a long history of 'laissez-faire' environmental quality management. Third is a mutual cooperation and coordination among the many entities involved in water quality standards and the involvement of people of diversified backgrounds in the field of areawide planning under Section 208 of the Feder-al Water Pollution Control Act, which is primarily concerned with non-point sources of water pollu-tion. (Bell Graf-Cornell)
W79-06675

WATER RESOURCES PLANNING--HISTORI-CAL DEVELOPMENT,
National Research Council, Washington, DC. Environmental Studies Board.
T. M. Schad.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 9-25, March 1979. 55 ref.

Descriptors: *Water resources, *Planning, *Statistical analysis, *Government agencies, *Public works, *History, Waterways, Estimating, Water policy, Forecasting, Conservation, Navigation, Transportation, United States, U.S. Corps of Engineers.

Water resources planning in the United States had its origin in efforts to improve waterways for navigation. Early planning was accomplished by the U.S. Army Corps of Engineers in connection with the construction of projects. Growth and development of the country led to a proliferation of government agencies involved in water re-sources, and the planning process gradually in-creased in complexity. The 'New Deal' in the 1930's resulted in increasing centralization of plan-ning, but in the 1960's an effort was made to regionalize the planning process. Various commit-tees and commissions have made recommendations for improvement of the planning process, and the planning techniques continue to evolve. The point has now been reached where many years of plan-ning are required before a project can be devel-oped to meet a perceived demand for water or water-related services. (Bell Graf-Cornell)
W79-06677

GROUNDWATER LAW,
K. Browning.
Pacific Groundwater Digest, Vol. 2, No. 3, p 29-30, March, 1979.

Descriptors: *Groundwater, *California, *Water management(Applied), *Legislation, *Ground-water basins, Water resources, Financing.

New groundwater legislation in California will re-quire the State Water Resources Board to desig-nate groundwater management areas, conduct groundwater resources investigations, and make recommendations for groundwater management areas. In addition, each area will be controlled by a local groundwater management authority who will submit a comprehensive management plan and send biennial reports to the governing board. These authorities will be financed through ground-water extraction charges and basin equity assess-ments. Other states, such as Nevada and Oregon are divided into groundwater basins. The State Water Resources Board studies and monitors the amount of discharge and recharge in each basin and have the authority to halt usage of ground-water only in critical areas. (Purdin-NWWA)
W79-06709

PROCEEDINGS OF THE BI-STATE CONFER-ENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
For primary bibliographic entry see Field 6B.
W79-06778

SHORELINES MANAGEMENT '77: PER-FORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Re-sources.
For primary bibliographic entry see Field 6G.
W79-06786

SAN LUIS VALLEY WATER PROBLEMS: A LEGAL PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Eco-nomics.
G. E. Radosevich, and R. W. Rutz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 918, Price codes: A06 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Information Series No. 34, January 1979. 109 p, 8 append. OWRT C-7144(6211)(1). 14-34-0001-6211.

Descriptors: *Water rights, Water law, Interstate compacts, *Irrigation, Institutions, Colorado, San Luis Valley, Rio Grande River.

The San Luis Valley stands at the crossroads of its economic future. Because of the existing water distribution system in the Valley and the superim-posed legal system and legal constraints, a deep insecurity has arisen among the people. Suspicion and economic fear are facts of life. As a result, a number of lawsuits have been filed during the past year, thereby deepening the division already pres-ent and draining large amounts of money out of the Valley to law firms located primarily in Denver. Presently, the Valley is a patchwork of local con-servancy districts, ditch companies, drainage dis-tricts, water users associations, etc., all interested in protecting their own areas of concern at the expense of any other person or group which might be deemed a threat to their interest. With the Closed Basin Drainage Project beginning, it is possible that there is enough water present in the Valley to fulfill existing water requirements with-out substantially harming the existing pattern of water use. To approach this objective a spirit of cooperation and trust must be developed, and a basic review of the legal principles controlling water must be made. The purpose of this report is to describe the water law condition and problems in the Valley. The following areas are discussed: the Rio Grande River and Colorado's commit-ments thereunder; the Closed Basin Project; Water Rights and Organizations in the Valley; Problems and Conflicts in the Valley; Developments in Colorado Water Law since 1973; and An approach to resolving the water problems now and in the future.
W79-06859

FOUR CORNERS REGIONAL STUDY OF PUBLIC AND LEGISLATIVE OPINION ON WATER AND OTHER NATURAL RESOURCE POLICIES,
Arizona Univ., Tucson. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W79-06892

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION--WHAT IS WRONG AND WHAT CAN BE DONE ABOUT IT,
For primary bibliographic entry see Field 5G.
W79-06904

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Spring-field.
For primary bibliographic entry see Field 5G.
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06906

FRAGMENTATION OF PUBLIC AUTHORITY OVER FLOODPLAINS: THE CHARLES RIVER RESPONSE,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
R. H. Platt, and G. M. McMullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 316, Price codes: A06 in paper copy, A01 in microfiche. University of Massachusetts Water Resources, Research Center Publication No. 101, 1979. 112 p, 8 fig, 8 tab, 38 ref, 3 append. OWRT-A-101-MASS (1), 14-34-0001-8023.

Descriptors: *Floodplain insurance, *Flood plain zoning, *Flood protection, Flood control, Massachusetts, Non-structural alternatives, Water law, Water policy, *Water management, Alternative planning, *Charles River.

Public authority to manage floodplains in the United States is fragmented among diverse political bodies: states, special district, counties, and municipalities. Each unit is vested with specific powers affecting the use of land and water resources within its boundaries. Differences in the plans, policies, and actions of individual entities give rise to adverse externalities affecting upstream, downstream, and cross-stream interests. Flooding may be increased in stage, frequency, and rapidity due to constriction of the channel or floodplain. This reduces the effectiveness of floodplain management efforts, both structural and nonstructural in neighboring areas. Issues arising from incompatible floodplain practices concern: (1) management versus non-management; (2) structural versus non-structural; (3) levels of protection; (4) compatibility of regulations; (5) natural flood storage areas. Joint undertakings which raise problems of coordination involve: (1) joint regulation; (2) joint acquisition; and (3) extraterritorial authority. The Charles River Watershed in Massachusetts is the scene of a complex experiment in intergovernmental floodplain management. Both structural and non-structural measures are employed. Participants include federal, state, regional, and local entities. Experience to date is examined and unresolved issues are set forth. (Godfrey-Mass)
W79-06916

6G. Ecologic Impact Of Water Development

SUBSIDENCE AND RELATED EFFECTS ON WASTEWATER COLLECTION AND TREATMENT FACILITIES.
Gulf Coast Waste Disposal Authority, Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 579, Price codes: A04 in paper copy, A01 in microfiche. Final Report 1976. 62 p, 1 fig, 2 tab, 29 ref.

Descriptors: *Land subsidence, Groundwater, *Water table, *Water quality, Texas, *Inflow, Water treatment, Performance, *Tides, Floods, Sewerage, Gulf coastal plain, Coliforms.

Land subsidence in the Houston area and its effects on domestic facilities and collection systems were investigated. A literature search indicated that inflow due to tidal flooding of previously dry areas was the only verifiable impact of land subsidence due to groundwater withdrawal. The mapping of Houston area subsidence-affected land areas and domestic water treatment plants involved identifying and mapping tidal flood-prone areas. Communities whose service areas or sewage plants had become partially inundated by regular flood tides were identified. The effects of subsided treatment plants on water quality involved increases in organic and nutrient loads and coliform bacteria contamination resulting from reduced waste water treatment facility efficiency. Twenty reports and articles dealing with land subsidence in general or land subsidence in the Houston area are summarized. (Small-FIRL)
W79-06562

WATER PLANNING AND THE ENVIRONMENT: 1776-1976,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 65-78, March 1979. 37 ref.

Descriptors: *Water resources, *Planning, *Environment, *Natural resources, *History, *Interagency cooperation, Federal government, Conservation, Government agencies, Social needs, Effects, Ecology, Economic decision criteria, Impact assessment.

The history of the ways in which environmental factors have been integrated into water resources planning is divided into three periods. During the first period, the years from 1776 to 1900, there was relatively little concern over the environmental impacts of water projects. The second period, from 1900 to 1970, represents a term during which environmental issues were concerned largely with the elimination of recklessness and waste and the efficient utilization of water resources. Environmental factors sometimes received consideration as a result of the concerns of citizens' groups and as a result of interagency coordination requirements. The third period, the years since 1970, represents a time during which water resources agencies have been routinely faced with a host of environmental concerns. Some of these relate to principal problems of the previous period, i.e., the efficient use of resources. Others however, e.g., the preservation of scarce natural environments and the maintenance of ecological stability and diversity, are relatively new issues. (Bell Graf-Cornell)
W79-06681

PACIFIC NORTHWEST RIVER BASINS COMMISSION: ANNUAL REPORT, FISCAL YEAR 1976,
Pacific Northwest River Basin Commission, Vancouver, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 947, Price codes: A02 in paper copy, A01 in microfiche. 1976. 20 p, 9 fig.

Descriptors: *Water resources, *Water resources development, *Regional development, *Pacific Northwest U.S., *Columbia River basin, Kootenai River Basin(Montana), Snohomish River Basin(Washington), *Land use, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Social aspects, Water policy.

The activities and programs of the Pacific Northwest River Basins Commission are summarized for the period July 1, 1975 through June 30, 1976. The Commission is preparing a water and related resources program intended to serve as a guide to decision makers. When completed, it will establish goals and objectives; identify issues, problems, and needs of the region; and offer programs for the best uses and institutional arrangements for managing the region's water and related resources. The Columbia River Estuary Special Proposal was forwarded to the Water Resources Council for funding along with the Snohomish River Basin Proposal to Study and a Proposal to Study for a Level B investigation of the Kootenai River Basin in Montana and Idaho. The 'Stewards of the River' program continued its objective to enhance the cultural, historical, educational, and esthetic aspects of the Columbia River and its major tributaries. Activities of the standing committees are reviewed, and a financial statement is included. (Davison-IPA)
W79-06771

UPPER MISSISSIPPI RIVER BASIN COMMISSION,
Upper Mississippi River Basin Commission, Twin Cities, MN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 950, Price codes: A02 in paper copy, A01 in microfiche. Fifth Annual Report, 1976. 22 p, 14 fig.

Descriptors: *Water resources, *Water resources development, *Upper Mississippi River Basin, *Land use, *Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Social aspects, Regional development, Water policy, Red River Basin(Minnesota).

The activities and programs of the Upper Mississippi River Basin Commission are summarized for the period July 1, 1975 through September 30, 1976. The U.S. Water Resources Council approved of the Commission's Proposal for the Study of the Upper Mississippi River Main Stem Level B program which was scheduled to begin during fiscal 1977. The ongoing coordinated management program is discussed. The Level B Study of the Water and Related Land Resources of the Minneapolis/St. Paul Metropolitan Area was completed in June 1976. A Comprehensive, Coordinated Joint Plan (CCJP) was adopted by the Commission for the Souris-Red-Rainy and Upper Mississippi Regions. The Commission has requested the U.S. Water Resources Council to provide $720,000 for a 2-year water related land resources study in the Red River Basin. The Commission's participation in the National Assessment of the Nation's water and related land resources is discussed, the Commission's CCJP is examined, and statewide planning assistance is reviewed. A financial statement is provided. (Davison-IPA)
W79-06772

MISSOURI RIVER BASIN COMMISSION ANNUAL REPORT, FISCAL 1976 AND TRANSITIONAL QUARTER,
Missouri River Basin Commission, Omaha, NE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 948, Price codes: A02 in paper copy, A01 in microfiche. 1976. 18 p, 12 fig.

Descriptors: *Water resources, *Water resources development, *Missouri River Basin, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Water policy, Land use, Regional development, Platte River Basin(Nebraska).

The activities and programs of the Missouri River Basin Commission are summarized for the period July 1, 1975 through September 30, 1976. The continuous planning effort of the Commission is embodied in the comprehensive, coordinated joint plan (CCJP) which currently consists of two elements: the conclusions and recommendations of the 1971 Framework Study Report, and the comprehensive plan developed by the 1976 Platte River Basin, Nebraska, Level B Study. The Platte River Basin of Nebraska is the first area to be included in a CCJP plan. A similar planning effort, the Yellowstone Basin and Adjacent Coal Field Area Level B Study, is underway. The Commission prepared and published two technical memoranda as part of the National Assessment program: a compilation of problems relating to the Basin's water and related land resources, and refinement of these problems along with water-oriented data for the Basin. The setting of priorities is discussed. The 'Federal and State Program Review' contains a comprehensive review of the water and related land resources studies, research, data collection, and implementation of projects and programs within the Basin. Committee activities are reported; a financial statement is included. (Davison-IPA)
W79-06773

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
For primary bibliographic entry see Field 6B.

W79-06778

[illegible] BASIN COMMISSION. 1976 ANNUAL REPORT,
Great Lakes Basin Commission, Ann Arbor, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 042, Price codes: A03 in paper copy, A01 in microfiche. [illegible] fig.

Descriptors: *Water resources, *Water resources development, *Great Lakes Basin, Planning, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Water policy, Water quality, Erosion, Land use, Sedimentation, Flood control, Recreation, Fish, Wildlife, Management, Social aspects, Regional development.

Highlights of the activities, programs, studies and a financial statement for the period July 1, 1975 through September 30, 1976, are reported. Among the members of the Great Lakes Basin Commission are the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. During the period the Commission continued to advocate increased State responsibility and involvement in all planning activities. Work began on the comprehensive coordinated joint plan for the Great Lakes. This is a broad effort to guide the use of water related resources as far as 50 years into the future. The Great Lakes Basin Framework Study, a comprehensive basic study on the Great Lakes System, was completed. The National Water Assessment--Great Lakes Region is scheduled for completion in 1978. 'Great Lakes Basin Programs 1976-1977' describes planning, research, and data acquisition programs conducted by government agencies during 1976. Progress is reported on Level B studies and policy studies. Activities of the various standing committees and States are reviewed. The Great Lakes Basin Library, open to the public, is a Selected Federal Depository Library and receives all Federal publications pertaining to water and land in the Great Lakes Basin. (Davison-IPA)
W79-06784

SHORELINES MANAGEMENT '77: PERFORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 928, Price codes: A08 in paper copy, A01 in microfiche. Report No WSG-W077-3, Washington Sea Grant Communications Program, Proceedings of a Conference held September 22-23, 1977, Seattle, Washington, 171 p, 2 fig, 1 tab, 18 ref, Goodwin, R. F., Editor.

Descriptors: *Planning, *Management, *Coasts, *Washington, Community development, Environment, Environmental effects, Cities, Estuaries, Shores, Conservation, Land management, Water resources development, Harbors, Recreation, Marinas, Legal aspects, Legislation, Zoning, Beaches, Lakes, Streams.

Twenty papers by authorities from government, academia, and other institutions are provided that deal with coastal management. The broad areas of coverage are: shoreline environmental management and community development, policies and guidelines for managing aquatic areas, legal and legislative issues, and shorelines management administration. (Davison-IPA)
W79-06786

NEW ENGLAND RIVER BASINS COMMISSION.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 949, Price codes: A02 in paper copy, A01 in microfiche. Annual Report, 1976. 20 p, 11 fig, 4 append.

Descriptors: *New England River Basins Commission, *Planning, *Management, *Water resources, *Land managements, *Environmental control, Water resources development, Regional development, River basin development, River basins, Continental shelf, Flood plains, Connecticut River.

During 1976 New England's attitude was for environmental management and protection. Although [illegible] ment with strong environmental controls, economic growth was also a goal. The New England River Basins Commission (NERBC) is responsible for preparing and keeping up-to-date a Comprehensive, Coordinated Joint Plan which recommends ways in which Federal, State and local governments and other institutions can manage water and related land resources wisely. The NERBC conducts individual studies dealing with complex severe regional problems and prepares basin 'planning guides.' The progress of the following studies is summarized: the Connecticut River Basin, Southern New England Basins, New Hampshire Basins, Lake Champlain Basins, and Maine Basins. Onshore oil and gas facilities are discussed. The activities of the Coastal Zone Task Force and the Outer Continental Shelf Task Force are reviewed. Preliminary conclusions regarding the NERBC's 1975 Assessment of Water and Land Resources are presented. The Task Force on Flood Plain Management focused on the three national programs: The National Flood Insurance Program, the Water Resources Council's unified national program for flood plain management, and new Federal regulations for wetland dredge and fill activity. A publications list and financial summary are included in the appendices. (Davison-IPA)
W79-06790

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 4, APPENDIX 4: WATER RELATED LAND RESOURCES.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 474, Price codes: A02 in paper copy, A01 in microfiche. (1977). 294 p, 70 fig, 29 tab, 274 ref, 4 append.

Descriptors: *Land resources, *Chesapeake Bay, *Future planning(Projected), *Land development, *Natural resources, *Water resources, Agriculture, Forestry, Mineralogy, Mapping, Regional development, Environmental effects, Delaware, Maryland, Virginia, District of Columbia, Social impact.

Findings of the Chesapeake Bay Study regarding future conditions of the region's land resources are presented. The study, coordinated with all Federal, State, and local agencies having interests in the Bay, includes the multi-disciplinary fields of engineering and the social, physical, and biological sciences. The study area was comprised of: The State of Delaware; Maryland excluding Frederick, Washington, Allegany, and Garrett counties; the Coastal Zone of Virginia; and Washington, D.C. Existing land use mapping was developed from U.S. Geological Survey maps, and future land use was projected and mapped by using county and regional comprehensive plans produced by local and regional planning agencies. The most current available data on water-related land resources of agriculture, forestry, and minerals were used to assess the present status of each land resource, project the future conditions of each, and determine the future problem areas of each resource. Future water resource needs and problem areas are projected to the year 2020. Recommendations for future studies and model testing required for developing a comprehensive management program for the Bay are included. (Davison-IPA)
W79-06793

CHESAPEAKE BAY FUTURE CONDITIONS REPORT VOL. 10, APPENDIX 13: ELECTRIC POWER, APPENDIX 14: NOXIOUS WEEDS,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 6B.
W79-06794

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 12, APPENDIX 16: HYDRAULIC MODEL TESTING,
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 482, Price codes: A05 in paper copy, A01 in microfiche. (1977), 72 p, 3 fig, 3 tab, 2 append.

Descriptors: *Chesapeake Bay, *Hydraulic models, *Model studies, *Hydraulic similitude, Research and development, Prototype tests, Tributaries, Physical properties, Salinity, Temperature, Elevation, Currents(Water), Velocity, Sea level, Sediments, Inflow, Freshwater, Baltimore Harbor, Estaurine environment.

The formulation of a first year hydraulic studies program for the Chesapeake Bay Hydraulic Model is reported. The hydraulic model of Chesapeake Bay provides a means of reproducing many natural events and man-made changes on a manageable scale, so that the necessary data may be collected to assess the results of these happenings. The model, located at Matapeake, Maryland, is a fixed bed geometrically distorted scale model hand molded in concrete; its nine acre area encompasses the Bay proper, all its tributaries up to the head of tidal effects, and the adjacent overbank areas to the contour of 20 ft above mean sea level. The model is expected to reproduce physical prototype data for the following: water surface elevation, salinity, current velocity, dye concentration from dye dispersion tests, temperature, and sediment distribution. The tests selected for the first year of testing were (1) Low Freshwater Inflow Study; (2) Baltimore Harbor Channel Enlargement Study, and (3) Combined Potomac Estuary Water Supply and Waste Water Dispersion Study. Other problems considered for inclusion in the first year studies program, and a priority ranking of the problems based on their economic, environmental and social impacts are discussed. The costs for operation and maintenance of the model complex during the performance of the three studies, estimated on the basis of October 19, 1976 prices, are $2,150,000. (Davison-IPA)
W79-06795

THE PREDICTABILITY OF RAIN AND THE FORAGING PATTERNS OF THE RED KANGAROO (MEGALEIA RUFA) IN CENTRAL AUSTRALIA,
Michigan Univ., Ann Arbor. School of Natural Resources.
B. S. Low.
Journal of Arid Environments, Vol. 2, No. 1, p 61-76, March 1979, 5 tab, 4 fig, 50 ref.

Descriptors: *Animal populations, *Animal behavior, *Food habits, *Kangaroos, *Rainfall disposition, Vegetation effects, Distribution patterns, Population dispersion, Density, Balance of nature, Environmental effects, Succession, Predation, Wildlife management, Seasonal, Australia, Forages, Biological communities, Forecasting.

Because the fate of desert animals is of increasing concern throughout the civilized world, studies of the adaptation mechanisms of desert wildlife to conditions of aridity are important in long-term efforts to preserve species most subject to man's predation. This particular investigation of the habitat of the red kangaroo (Megaleia rufa) in Australia's central desert considered how the amount, variation, and predictability of rainfall affected the density and dispersion of feeding kangaroos, and how these effects interacted with other parameters such as the vegetative composition of the community, season, available free water, and cover. Rainfall was measured weekly by 20 gages and soil moisture computed by .8 km square quadrats. Aerial surveys were flown three times per month to determine kangaroo density and dispersion patterns. Results indicate that both community type and season significantly influenced density, but only community type greatly affected feeding. No evidence could be found that long-term differences in rainfall levels affected densities, and water availability appeared to have no affect on feeding dispersion. The importance of community types ap-

pears to be related primarily to predation pressure, a factor now considered of increasing importance in wildlife management practices. (Tickes-Arizona)
W79-06835

THE MORPHOGENESIS OF IRANIAN CITIES,
Arizona Univ., Tucson. Dept. of Oriental Studies.
M. E. Bonine.
Annals of the Association of American Geographers, Vol. 69, No. 2, p 208-224, June 1979. 16 fig, 1 tab, 56 ref.

Descriptors: *Iran, *Regional development, *Urban hydrology, *City planning, *Distribution systems, *Irrigation canals, Planning, Regional analysis, Water resources development, Networks, Urban mapping, Community development, Drainage systems, Institutions, Institutional constraints, History, Irrigation systems, Open channels, Water conveyance.

It is this author's belief that in Iran an orthogonal network of streets exists in traditional Iranian cities which do not conform to a maze of irregular lanes built around rectangular religious building to facilitate maximum seasonal use but rather are the result of building to accomommodate irrigation systems. The development of grid systems of main streets are described and illustrated in several Iranian cities which were constructed during the pre-industrial Iranian economy and rationally established in conjunction with systems of channels used to irrigate agricultural land. Accordingly, the orientation of the resulting orthogonal networks was determined by the need to arrange the rectangular fields and orchards to the slope of the land, and future housing construction was governed by the pre-existing system of fields and passageways. Irrigation and agricultural practices, then, have played an overriding role in the establishment of the morphology of traditional Iranian cities and expansion has been along existing streets and water channels. (Tickes-Arizona)
W79-06842

7. RESOURCES DATA

7A. Network Design

UTILIZATION AND INTERPRETATION OF HYDROLOGIC DATA WITH SELECTED EXAMPLES FROM NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resource Research Center.
F. R. Hall, and S. L. Dingman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 393, Price codes: A06 in paper copy, A01 in microfiche. Research Report No. 20, 1979. 92 p, 20 fig, 11 tab, 29 ref. OWRT A-040-NH (2), 14-31-0001-4029.

Descriptors: *Hydrologic data, *Flow-duration curves, Data analysis, *Regression analysis, Flow rates, Streamflow, Statistical methods, Flood frequency, Low flows, New Hampshire.

The modern emphasis on comprehensive planning and environmental studies has created a increasing demand for the interpretation and utilization of hydrologic data. A potential user of such data is faced with at least three kinds of problems: (1) Availability of data and adequacy of data collection programs; (2) What to do with the data that are available; and (3) How to transfer available data from a collection site to an unmeasured location of interest. This report focuses on interpretation and utilization of available data. The examples are drawn from streamflow records. The general plan of the report is to give examples of various ways of manipulating and interpreting streamflow data. First, there is a discussion of data sources and useful works available in the hydrology literature. This is followed by a section which deals with the basic elements of frequency analysis. Then there is a more detailed description of how to synthesize flow duration curves for ungaged areas. This is followed by a section which has an application of a regional flood analysis, mainly by graphical methods. The report is concluded with selected examples of the use of regression analysis.
W79-06502

NONPOINT SOURCE SAMPLING DESIGN REPORT AREAWIDE WASTE TREATMENT MANAGEMENT PLAN FOR THE GREATER HOUSTON AREA.
Dannenbaum Engineering Corp., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 758, Price codes: A06 in paper copy, A01 in microfiche. Final Report, 1977. 113 p, 27 tab, 3 ref, 3 append.

Descriptors: Texas, Cities, *Water pollution sources, *On-site data collections, *Data storage and retrieval, Water quality, *Monitoring, Land use, Watersheds(Basins).

A procedure was developed for the establishment of a sampling program and resulting data base for the characterization of non-point sources of water pollution within the Greater Houston 208 planning area. Currently active water quality monitoring programs were reviewed and found to yield insufficient data on non-point sources due primarily to the nonhomogeneousness of the upstream contributory watersheds. Only intensive, event-type sampling can be effective in non-point pollutant identification and quantification. Also, the development of acceptable land use water quality relationships is necessary. (Small-FIRL)
W79-06569

GROUNDWATER DATA COLLECTION IN THE WATER DATA UNIT,
Her Majesty's Stationery Office, London (England). Archive Section.
For primary bibliographic entry see Field 7C.
W79-06792

LANDFILL CELL DESIGNED FOR HAZARDOUS WASTE DISPOSAL,
Florida State Dept. of Public Works, Jacksonville. Sanitation Div.
For primary bibliographic entry see Field 5G.
W79-06863

GROUND-WATER COMPUTER MODELS - INTELLECTUAL TOYS,
For primary bibliographic entry see Field 7C.
W79-06907

7B. Data Acquisition

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT I DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
For primary bibliographic entry see Field 5A.
W79-06600

TO MARK SAMPLING EVENTS ON A RUNOFF HYDROGRAPH,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
A. T. Johnson, R. Kort, and J. E. Ayars.
Agricultural Engineering, Vol. 59, No. 9, p 22-23, September, 1978. 2 fig.

Descriptors: *Runoff, *Hydrographs, Intermittent streams, Instrumentation, Stream gages.

A Stevens Type F Water Stage Recorder can be modified to make it more practical for runoff studies and to monitor streams where flow is intermittent. The modification is described. (Skogerboe-Colorado State)
W79-06697

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 4A.
W79-06762

SNOW SURVEY AND VEGETATION GROWTH IN THE SWISS ALPS,
Zurich Univ. (Switzerland). Dept. of Geography.
H. Haefner.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-25626, Price codes: A03 in paper copy, A01 in microfiche. Final Report of Swiss EREP-Project No. 323, December 1975. 38 p, 18 fig, 5 ref.

Descriptors: *Remote sensing, *Snow cover, *Vegetation, Satellites(Artificial), Data processing, Snow, Snow surveys, Analytical techniques, Mapping, Classification, Mountains, Alpine, *Swiss Alps, *Switzerland.

Analog processing of S-190-A and B color and IR-color transparencies showed that it is possible to evaluate the courses of the temporary snow line and the upper limit of vegetation growth over large areas. By transferring the results from S-190-A onto a topo-map 1:200,000, an accuracy of + or - 50 m could be achieved. With S-190-B transferred onto a map 1:100,000, an accuracy of + or - 20 m was reached. A compilation of the altitudinal position of these boundaries in different regions, exposures, etc. showed very significant variations for a specific date (September 11, 1973). The upper limit of vegetation growth oscillates between 2,000 and 3,100 m, while the difference between upper boundary of vegetation growth and snow line varies from 450 to 900 m. No comparative synoptic regional data of such kind was available until now. Digital processing of S-192 multispectral data allowed a separation of snow and clouds by combining the information from channels 9 (0.78 - 0.88 micrometer), 15 (1.55 - 1.75 micrometer) and 18 (0.46 - 0.51 micrometer). The developed processing sequence included preprocessing steps, feature extraction, and data output in form of a maplike image of a selected scale with a photomation system. The classification procedure is supervised, based on euclidean distances. (Sims-ISWS)
W79-06764

INORGANIC POLLUTION IN WATER--THE ANALYST'S VIEWPOINT,
Geological Survey, Denver, CO. Water Resources Div.
M. W. Skougstad, and M. J. Fishman.
Toxicological and Environmental Chemistry Reviews, Vol. 2, p 219-236, 1978. 7 fig, 7 tab.

Descriptors: *Water pollution, *Inorganic compounds. *Water analysis, *Chemical analysis, *Analytical techniques, Instrumentation, Laboratory tests, Trace elements, Heavy metals, *Data reliability, *Standard reference water samples.

Inorganic pollution comprises both major and minor constituents, although only 12 chemical elements may be considered major components. Twenty-eight elements constitute a group of common minor elements and an additional 13 elements comprise a group of less common minor constituents. Reliable quantitative data are required on the occurrence of these substances in a wide variety of water types, usually at extremely low concentrations. The analysis of standard reference water samples provides information on the overall reliability of water-quality data. Although most major constituents may be determined with acceptable reliability, determinations of certain minor constituents lack comparable precision; for example, determinations of boron, nickel, and chromium. Few precision data are available on the determination of the less common trace elements. Several comparatively new analytical techniques, such as flameless atomic absorption spectrophotometry, voltammetry, and emission spectroscopy with plasma excitation, appear capable of providing improved sensitivity. (Woodard-USGS)
W79-06821

ON THE APPROXIMATION OF SATURATION VAPOR PRESSURE,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Rasmussen.
Journal of Applied Meteorology, Vol 17, No 10, p 1564-1565, October 1978. 1 tab, 4 ref.

Descriptors: *Vapor pressure, *Saturation, *Thermal properties, *Meteorology, *Model studies, Analytical techniques, Numerical analysis, Atmospheric physics, Equations, Evaluation.

The saturation vapor pressure of water vapor in the atmosphere is an important variable in many meteorological processes. Numerical approximation of the dependence of this variable on temperature is necessary in the modeling of these processes. Given here are the coefficients of eight approximating functions, five polynomials and three rational functions, for the saturation pressure with respect to a liquid water surface for the temperature intervals (-50C, +50C) and (0C, +50C), and with respect to an ice surface for the interval (-50C, 0C). Considering both the required computation time and the resulting error, these functions compare favorably with others published recently. (Woodard-USGS)
W79-06826

SATELLITE SURVEILLANCE OF PHYSICAL WATER-QUALITY CHARACTERISTICS,
Geological Survey, Sioux Falls, SD. Water Resources Div.
G. K. Moore.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, April 20-26, 1978, p 445-462, 1978. 10 fig, 2 tab, 15 ref.

Descriptors: *Remote sensing, *Surface waters, *Turbidity, *Color, *Satellites(Artificial), Infrared radiation, Solar radiation, Atmosphere, Light penetration, Particle size, Suspended load, Bottom-reflected light, Spectroscopy, *Landsat images, *Solar flux, *Energy backscatter, Specular reflection.

Remote sensing instruments obtain an optical measure of water color and turbidity. Color increases the absorption of light in water and decreases the remote signal; turbidity increases the backscatter of light. Satellite surveillance of water turbidity presently is evaluated as a costly way of obtaining information, but several potential applications may be economical. These include the use of turbidity as an index to streamflow velocity and to the productivity of lakes, estuaries, and oceanic fishing grounds. (Woodard-USGS)
W79-06829

PRACTICAL METHODS OF AIMING ANTENNAS AT GEOSTATIONARY SATELLITES,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
L. A. Reid.
Technical Bulletin No 104, 1978, 10 p, 7 fig, 4 ref.

Descriptors: *Satellites(Artificial), *Data transmission, *Data collections, *Hydrometry, *Geostationary Operational Environmental System(GOES), *Antennas, Hydrometeorology, Sensors.

The procedure for aligning Data Collection Platform (DCP) antennas in the Geostationary Operational Environmental Satellite (GOES) System is presented. A method is given for determining (a) the angle of elevation and (b) the azimuth or bearing, to which an antenna must be set to bring it in line with a satellite. Two detailed methods, one using a compass and the other a watch, are presented for setting an antenna on the predetermined bearing. (WATDOC)
W79-06851

STREAM NETWORK ANALYSIS AND GEOMORPHIC FLOOD PLAIN MAPPING FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY APPLICATION TO FLOOD HAZARD STUDIES IN CENTRAL TEXAS,
Texas Univ. at Austin. Dept. of Geological Sciences.
V. R. Baker, R. K. Holz, S. D. Hulke, P. C. Patton, and M. M. Penteado.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-30620, Price codes: A09 in paper copy, A01 in microfiche. Final Report, EREP No. 064B, April 30, 1975. 196 p, 72 fig, 10 tab, 127 ref. NASA 9-13312.

Descriptors: *Remote sensing, *Floods, *Texas, Satellites(Artificial), Aircraft, Watersheds(Basins), Streams, Drainage, Mapping, Flood peak, Hazards, Topography, Topographic mapping, Geomorphology, Climatology, Hydrology, Skylab.

Flood hazard evaluation can be approached from two viewpoints. An 'upstream' approach would consist of evaluating the interaction of rainfall inputs and physiographic factors in producing flood responses on small watersheds. A 'downstream' approach would map flood hazard zones in the broad alluvial valleys which rivers develop after collecting the flow of numerous tributaries. In this report, an attempt was made to apply remote sensing imagery to both aspects of the flood hazard evaluation problem. This report has two general parts. The first part concerns upstream controls through a discussion of the adjustment of stream network geometry to climatic and geologic factors. The second part of the report concerns downstream flood problems through a discussion of floodplain mapping techniques. (Sims-ISWS)
W79-06877

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
A. P. Pajak, E. J. Martin, G. A. Brinsko, and E. J. Erny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 724, Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/2-77-239, 1977. 200 p, 1 fig, 4 tab, 78 ref.

Descriptors: *Biological treatment, *Activated sludge, *Chemicals, *Water pollution effects, *Industrial wastes, Biodegradation, Waste water treatment, Chemical wastes.

A method has been developed for evaluating the effects of various chemical substances on biological waste water treatment processes. The analysis utilizes a matrix format where more than 250 chemicals are listed alphabetically. Data listed in the matrix for each chemical substance include: a description of the chemical substance; its effect on the treatment process parameters, especially the activated sludge process; and the effects of the treatment process on the chemical substance. Data and results from bench scale, pilot plant, and full scale studies are also supplied. The matrix is arranged in a format that is suitable for its use as an operations handbook. (Lisk-FRC)
W79-07000

7C. Evaluation, Processing and Publication

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W79-06590

PROGRAMMING A POCKET CALCULATOR FOR SOLVING MULTIPLE WELL, VARIABLE PUMPING RATE PROBLEMS,
Stone and Webster Engineering Corp., Boston, MA.
L. W. Picking.
Ground Water, Vol 17, No 2, p 205-208, March-April 1979. 2 fig, 1 tab.

Descriptors: *Groundwater, *Computer programs, *Theis equation, *Computers, Water wells, Pumping, Equations, Mathematical studies, Mathematics, Wells, Pocket calculators, Multiple wells, Variable pumpage, Image well theory, Superposition.

Several of the newer models of programmable pocket calculators can accept programs that permit them to rapidly and accurately solve the Theis converging series formula. By freeing the Theis equation from the W sub (u) reference table, multiple well, variable pumping rate programs can be designed for operation on a simple input-output basis, using additive drawdown and image well theory. (Visocky-ISWS)
W79-06593

CHANGING PATTERNS OF GROUND-WATER USE IN THE UNITED STATES,
NSF Science for Citizens Program, Madison, WI.
A. Zaporozec.
Ground Water, Vol 17, No 2, p 199-204, March-April 1979. 5 fig, 2 tab, 7 ref. NSF OSS 77-23964.

Descriptors: *Water utilization, *United States, *Water resources, *Data collections, Groundwater, Water supply, Rural areas, Irrigation water, Surface waters, Municipal water.

The increasing use of groundwater and its true role as a source of water supplies in the United States have sometimes been interpreted incorrectly. The total use of groundwater has indeed increased tremendously during the last 20 years (by almost 80%), but so has the total use of water (over 70%). And groundwater is still far from being a primary source of water supplies. In 1975, only 20% of the total amount of water withdrawn in the United States for various uses came from groundwater sources. Statistical analysis of groundwater data for the period 1950-1975 has shown that the groundwater usage is changing only very slowly. Relation of groundwater use to total water use expressed in percent was used as an indicator of changes of groundwater use patterns. This percentage has not changed significantly, and it has fluctuated around 19%. In 1975, only 6 states used more groundwater than surface water for their water supplies, and in 23 states groundwater use was less than 10% of total use. Even more unfavorable is the magnitude of change in ratio of groundwater use relative to total water use. From 1955 to 1975, only 13 states show an increase in the ratio. In 28 states the ratio has decreased, and in 7 it has remained the same. (Humphreys-ISWS)
W79-06594

GROUND-WATER COMPUTER MODELS--STATE OF THE ART,
Camp, Dresser and McKee, Inc., Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-06595

RELATIONSHIPS BETWEEN CONCENTRATIONS AND DISCHARGE ON SELECTED ILLINOIS STREAMS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W79-06737

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 227, March 1979. 68 p, 18 tab, 72 ref, 24 map.

Descriptors: *Groundwater resources, *Texas, *Aquifers, *Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping,

Projections, Saturated flow, *Gaines County(TX), *Ogallala aquifer(TX), Pumpage rates, Pumping lifts, Well yields.

This is one numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contained maps, charts, and tabulations which reflect estimates of the volume of water storage in the Ogallala aquifer in Gaines County and the projected depletion of this water supply by decade periods through the year 2020. The report also contained estimates of pumpage, pumping lifts, and other data related to current and future water use in the county. However, the report did not attempt to project that portion of the volume of water in underground storage which may be ultimately recoverable. The Ogallala aquifer in Gaines County contained approximately 9.9 million acre-feet of water in 1974. Historical pumpage has exceeded 200,000 acre-feet annually, which is more than twice the rate of natural recharge to the aquifer in the county. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. There is a very uneven distribution of groundwater in the county. Some areas have ample groundwater resources to support current usage through the year 2000; whereas, in other areas, groundwater is currently in short supply. To obtain maximum benefits from the remaining groundwater resources, water users should implement all possible conservation measures so that the remaining groundwater supply is used in the most prudent manner possible and with the least amount of waste. (Humphreys-ISWS)
W79-06738

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
For primary bibliographic entry see Field 2F.
W79-06742

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
D. M. Woller, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 724, Price codes: A02 in paper copy, A01 in microfiche. ISWS Bulletin 60-27, 1979. 20 p, 1 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, *Morgan County(IL), *Scott County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public water supplies in Morgan and Scott Counties, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for 7 public water supply systems furnishing water to 10 municipalities, 3 state institutions, and 1 water commission. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well included the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, K. L. Kunz, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 977, Price codes: A02 in paper copy, A01 in microfiche. ISWS Bulletin 60-26, 1979. 20 p, 1 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, *Pike County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Pike County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for groundwater supplies of 11 municipalities in Pike County. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-06769

GROUNDWATER DATA COLLECTION IN THE WATER DATA UNIT,
Her Majesty's Stationery Office, London (England). Archive Section.
M. L. Lees.
Water Services, Vol. 83, No. 997, p 180-185, March, 1979. 4 tab, 10 ref.

Descriptors: *Great Britain, *Data collections, *Groundwater, *Data storage and retrieval, Aquifers, Water levels, Water quality, Hydrographs, Hydrologic data, Weather data, Statistics, Water utilization, Water supply, Computers, Documentation, Publications, Observation wells, Water level recorders.

Statistics on the increasing use of groundwater for public supplies in England and Wales are presented in tabular form. The principal aquifers and their contribution to the total ground water supply are listed. The Chalk, Lower Greensland and the Triassic sandstones are the most important aquifers. In general, the older geologic systems have limited ground water potential. In many areas aquifers may be developed for local supplies. Groundwater data collection using a network of observation wells with automatic water level recorders began after passage of the Water Resources Act of 1963. The Water Data Unit processes the data into a computer and based storage system. The data is published periodically in Ground Water: United Kingdom, Ground Water Year Book, and Water Data. Examples are presented of groundwater hydrographs which are available from the Water Data Unit Archives. Other retrievals are available as printed tables. At present, there is no central system for collecting a digest of chemical and bacteriological analyses of groundwater in England and Wales. If this data is incorporated into the computer-based storage system, compositional maps of groundwater can be produced. (Purdin-NWWA)
W79-06792

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div
H. R. Seitz, and R. F. Norvitch.
Geological Survey Water-Resources Investigations 79-14 (open-file report), February 1979. 53 p, 1 fig, 2 tab, 27 ref.

Descriptors: *Water quality, *Groundwater, Water chemistry, *Groundwater movement, *Geochemistry, Water pollution, Salinity, Aquifers, Water wells, Water analysis, Chemical analysis, Dissolved solids, Nitrogen, Chlorides, Hardness(Water), Well data, Groundwater recharge, Water table, Water treatment, Sampling, Standards, Irrigation water, Idaho, *Bear Lake Valley, *Marsh Valley, *Portneuf Valley, *Gem Valley.

The 103 wells sampled during the study establish a quasi-network that could be resampled in the future to document and analyze changes in ground-water quality in the southeastern Idaho study area. The main aquifers are categorized as alluvium of Quaternary age, basalt of Quaternary and (or) Tertiary age, rocks of the Salt Lake Formation of Tertiary age, and undifferentiated bedrock of pre-Tertiary age. Dissolved solids, hardness, nitrite plus nitrate as nitrogen, and chloride concentrations in the ground waters ranged from 165 to 1,690; 78 to 1,700; 0 to 29; and 1.9 to 360 milligrams per liter, respectively. The areal distributions of these constituents are shown on maps. The range and median values of these same constituents are tabulated by aquifer occurrence. Some of the most mineralized and hardest waters occur in the basalt aquifer near travertine deposits (or terraces), which are composed of calcium carbonate precipitates from mineral springs. For irrigation purposes, all the waters are classified as having low-sodium hazard. Most have medium- to high-salinity hazard. (Woodard-USGS)
W79-06814

WATER-RESOURCES INVESTIGATIONS IN FLORIDA, 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Resources Investigations in Florida folder, 1978. 1 sheet.

Descriptors: *Water resources, *Projects, *Florida, *Water quality, Surface waters, Groundwater, Data collections, Sites, Maps, Bibliographies, Publications.

The folder describes past and present water-resources investigations in Florida conducted by the U.S. Geological Survey in cooperation with the Florida Department of Environmental Regulation and other State, municipal, and Federal agencies. Included are: (1) A large map of the State that shows the location of over 425 surface-water sites where streamflow and water-quality data are collected, (2) sites where groundwater-level data are collected, and (3) the location of 48 USGS water-research projects currently under investigation. The folder lists more than 360 water-resources reports and maps. (Woodard-USGS)
W79-06822

WETLAND CLASSIFICATION SYSTEM FOR THE TENNESSEE VALLEY REGION,
Geological Survey, Reston, VA. Water Resources Div.; and Tennessee Valley Authority, Norris, TN. Div. of Forestry, Fisheries, and Wildlife Development.
V. Carter, and J. H. Burbank.
Tennessee Valley Authority Technical Note No. B24, June 1978. 36 p, 14 fig, 2 tab, 29 ref.

Descriptors: *Wetlands, *Classification, *Vegetation, *Methodology, *Tennessee Valley Authority, Hydrologic budget, Management, *Tennessee Valley region.

A wetland classification system for the Tennessee Valley region is described. The wetland classes and subclasses are based on vegetation and frequency and duration of inundation. There are 6 wetland classes and 12 wetland subclasses. This system is compared with other existing classification systems. (Woodard-USGS)
W79-06823

THE OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER,

RAND STRAND AREA AND SURROUNDING
ARTS OF HORRY AND GEORGETOWN
OUNTIES, SOUTH CAROLINA,
eological Survey, Columbia, SC. Water Re-
urces Div.
Zack.
outh Carolina Water Resources Commission
eport No. 8, 1977. 100 p, 33 fig, 5 tab, 19 ref.

escriptors: *Groundwater resources, *Ground-
ater availability, *Water quality, *Aquifer char-
teristics, *Geologic formations, Water wells,
ater yield, Water levels, Hydrogeology,
roundwater movement, Saline water intrusion,
roundwater recharge, Specific capacity, Chemi-
l analysis, Aquifer management, South Carolina,
lorry County, *Georgetown County.

n evaluation of developing water-well and water-
ality problems in the coastal aquifer systems of
orry and Georgetown Counties, S.C., was initiat-
in 1972. Geologic cross sections detail the strati-
aphic relationships of sand, clay, and calcareous
ndstone and also establish formational boundaries
tween Tertiary formations boundaries between
ertiary formations and the Peedee, Black Creek,
d Middendorf Formations. The Black Creek
uifer system is the most satisfactory source of
od-quality water in the two-county area. Usually
e water is soft, low in chloride, and iron- and
lfate-free. However, fluoride concentrations are
cessive, reaching 5.5 milligrams per liter in some
eas. Water in the Peedee Formation and Tertiary
rmations, although low in fluoride and chloride,
ten contains excessive concentrations of iron,
drogen sulfide, and sulfate. Treatment would be
cessary before this water could be considered
r a domestic water supply. Water in the Midden-
rf Formation is salty presumably throughout the
o-county area. A typical value of the hydraulic
nductivity of Black Creek sand beds is 30 feet
r day, but it is less in central and southern
eogetown County. An average value of specific
orage of 0.0000026 per foot has been calculated
om pumping tests throughout the area. (Woo-
rd-USGS)
79-06831

ETHANE MIGRATION AROUND SANI-
ARY LANDFILLS,
hio State Univ., Columbus. Dept. of Civil Engi-
ering.
or primary bibliographic entry see Field 5B.
79-06843

OCATION OF MUNICIPAL WELL FIELDS
N AN ENVIRONMENTALLY SENSITIVE
EGION,
eraghty and Miller, Inc., Tampa, FL.
or primary bibliographic entry see Field 6B.
79-06855

OME PROBLEMS IN EVALUATING THE
BILITY OF STRATA TO STORE OR TRANS-
IT POLLUTANTS,
anchester Univ. (England). Dept. of Civil and
ructural Engineering.
or primary bibliographic entry see Field 5B.
79-06862

MPACT OF WASTES FROM A WATER
REATMENT PLANT: EVALUATIVE PROCE-
URES AND RESULTS,
linois State Water Survey, Urbana.
or primary bibliographic entry see Field 5E.
79-06889

ROUNDWATER LEVELS AND PUMPAGE IN
HE EAST ST. LOUIS AREA, ILLINOIS, 1972-
77,
linois State Water Survey, Urbana.
or primary bibliographic entry see Field 2F.
79-06890

ROUND-WATER COMPUTER MODELS - IN-
ELLECTUAL TOYS,
H. A. Baski.
Ground Water, Vol. 17, No. 2, p 177-179, March-April, 1979.

Descriptors: *Computer models, *Hydrogeology, *Projections, Computer programs, Ground water, Aquifer characteristics, Model studies, Basic data collections.

Misuse of ground water computer models through misapplication, oversell, and questionable methods may destroy confidence in them both outside and within the ground water profession. Ground water computer models can be useful tools for making projections using aquifer and confining bed characteristics as input. For short-term projections, transmissivity is the key item. However, for long-term projections recharge and storage coefficient become more important. The degree of uncertainty in the input will determine the accuracy of the output. Other types of models that can be used for projections include flow nets, well formulas, heat flow formulas, and extrapolations. Regardless, of what model is used, the collection and interpretation of good basic data is of the utmost importance for accurate projections. (Purdin-NWWA)
W79-06907

GROUND-WATER COMPUTER MODELS - PRACTICAL TOOLS,
Wright Water Engineers, Inc., Denver, CO. Ground Water Div.
R. E. Darr.
Ground Water, Vol. 17, No. 2, p 174-175, March-April, 1979. 9 ref.

Descriptors: *Groundwater, *Computer models, *Water management(Applied), *Hydrogeology, Computer programs, Computers, Wellfields, Conjunctive use, Solutes, Statistical models, Calculators.

Models that can be programmed on computers or hand-held calculators are valuable and practical tools for the ground water manager in solving complex problems for wellfields, conjunctive use, solute transport, and statistics. The digital computer, the analog, and hybrid computers have been used very effectively for hydrogeologic models. A valid model must conform to the law of mass balance (i.e., the water in must equal the water out plus the water stored) and Darcy's Law. Computer models are most useful where there is a lack of data and a quick approximation is needed. They vary in complexity and cost depending on the type of problem and the degree of accuracy required. The practicality of such models and their results is a function of the intelligence of the user. Models are only time-saving tools which require data collection, practical human experience, judgment evaluations and common sense to program and interpret. (Purdin-NWWA)
W79-06908

DATA MANAGEMENT SYSTEM (DMS) FOR TIME SERIES,
Hydrocomp Inc., Palo Alto, CA.
J. J. Heler.
Transactions of the ASAE, Vol. 22, No. 1, p 122-125, Jan.-Feb. 1979. 5 fig.

Descriptors: *Data management, *Time series, Hydrologic data, Meteorological data, Data organization, Data compression, System mode, System operation, Capabilities, Systems analysis, Computer programs.

Agencies which collect hydrometeorological or related information find that the volume of data increases rapidly. Also, new techniques in hydrologic and water quality analysis are being developed, and these require more kinds of data and create greater problems in management. Modern analytical methods are computer based; thus it is desirable to have a data retrieval system within the same software to allow direct transfer of information. Hydrocomp Inc. has developed a data management system as part of the modernization and improvement of its analysis tools. This system is a component of a new release of Hydrocomp simulation software called Hydrocomp Simulation Processor II (HSPII). This paper describes Data Management System (DMS) capabilities. In addition to storing and retrieving a considerable amount of information collected as time series, the system can be used to perform a variety of analyses on transformations of these data and print out in tabular or graphical form the original data series or its transformation. DMS is suitable to a wide variety of applications; it can store and process any data collected as a sequence in time. It is a useful analytical tool presented for agencies who are considering a conversion to modern computer-based data management. (Bell Graf-Cornell)
W79-06928

8. ENGINEERING WORKS

8A. Structures

SEWER SYSTEM EVALUATION, REHABILITATION AND NEW CONSTRUCTION A MANUAL OF PRACTICE,
American Public Works Association, Chicago, IL.
R. H. Sullivan, M. M. Cohn, T. J. Clark, W. Thompson, and J. Zaffle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 248, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-017d, 1977. 117 p, 23 fig, 13 tab, 4 ref, 6 append.

Descriptors: *Infiltration, *Sewers, *Sewerage, Design, *Evaluation, Inspection, *Rehabilitation, Costs, Waste water, Design standards.

This manual discusses three areas of infiltration/inflow of sewer systems: sewer system evaluation, sewer rehabilitation, and design of new systems to minimize infiltration/inflow. Procedures for conducting the System Analysis and Sewer System Evaluation (SSES) by local authorities and consulting engineers are described in detail. Methods of sewer inspection and sewer cleaning equipment are discussed, and cost factors are given. Rehabilitation techniques are described. Establishment of infiltration limits for new sewer construction is recommended at a rate not to exceed 20 gal/inch diameter/mile/day. Testing for infiltration limits is described. (Small-FIRL)
W79-06506

SUBSURFACE WASTE-HEAT STORAGE: EXPERIMENTAL STUDY,
Auburn Univ., AL. Water Resources Research Inst.
J. C. Warman, F. J. Molz, and T. E. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as ORO-5003-1, Price codes: A02 in paper copy, A01 in microfiche. Final Report No. ORO/5003-1, June 30, 1977. 67 p, 7 fig, 1 tab, 23 ref, 1 append. E-(40-1)-5003.

Descriptors: *Waste storage, *Heat, *Injection wells, Hydraulics, Heat transfer, Instrumentation, On-site investigations, On-site tests, Wells, Well data, Well spacing, Drilling, Pumping, Porosity, Thermal conductivity, Porous media, Porosity, Water utilization.

Confined aquifers are used as storage reservoirs for moderate to high temperature water in proposed electrical power plant and solar heating systems. An experimental program was undertaken to test the heat storage well concept and to provide data for the calibration of mathematical models. The experimental program was in four phases. In Phase I an exploratory well was drilled at the selected field site. Construction of the central injection well and three observation wells took place during Phase II as well as preliminary pumping tests. During Phase III the remainder of the observation well field was constructed, final pumping tests were performed, and the measurement of aquifer thermal properties were taken. Phase IV involved a cycle of warm water injection, storage and recovery. It is concluded that: heat storage aquifers need low natural pore velocities; require the use of heated water with low suspended solids, or clog-

ging will become a serious problem; the swelling of clays must be minimized; hydraulic pressures capable of breaching the confining layers must be avoided; and the use of formation water as influent to the heating system may minimize clogging problems. The calculated energy recovery factor of 0.68 on storage of two million gallons for 36 days was considered promising. (Davison-IPA)
W79-06565

TRANSIENT SEEPAGE ANALYSIS OF GURI DAM,
Harza Engineering Co., Chicago, IL. Hydrology Analysis and Design Div.
C-Y. Wei, and W. Y. J. Shieh.
Journal of the Technical Councils, American Society of Civil Engineers, Vol 105, No TCI, Proceedings Paper 14503, p 135-147, April 1979. 8 fig, 1 tab, 14 ref, 1 append.

Descriptors: *Dams, *South America, *Earth dams, *Seepage, *Model studies, Mathematical models, Finite element analysis, Soil water, Hydraulic conductivity, Porous media, Soil water movement, Saturated soils, Pore water, Pore pressure, Reservoirs, Dam design, *Venezuela, *Guri Dam(Venezuela).

The transient seepage analysis of the 95-m high Guri earthfill dam was undertaken to investigate the saturation of earthfill and foundation during and after staged reservoir filling. Saturated-unsaturated porous media flow theory and Galerkin-type finite element techniques were applied. The phreatic surfaces were treated as zero pore pressure lines. The zero pore pressure line was obtained from the calculated pore pressures, including negative pressures in partially saturated zones. The movements of the saturation (wetting) fronts and the pore pressure distributions in the earthfill and its foundation were used in the investigation of deformation and stability of the Guri earthfill dam under staged construction and reservoir filling. (Sims-ISWS)
W79-06587

BOTSWANA AND MALAWI RURAL WATER SUPPLIE.
Water Services, Vol. 82, No. 993, p 784, 786, November, 1978.

Descriptors: *Botswana, *Malawi, *Water supply development, Africa, *Rural areas, Diseases, Water distribution, Pipelines, Groundwater, Water wells.

About 80% of human and livestock water requirements in Botswana depend on ground water supplies. Under the British Aid Programme, 65,000 villagers will obtain water piped from existing wells. 30% of the wells were in need of maintenance and rehabilitation before pipelaying could begin. This water distribution system not only will reduce the spread of water-borne diseases through contaminated drinking water, but will save time and energy in carrying water that could be spent better in growing vegetables. The Malawi rural water supply project brings similar benefits but differs from the Botswana project in two ways. First, the water supply is gravity-fed from mountain streams and lakes. Secondly, the construction of the system is done entirely by groups of villagers. Local village leaders are taught to maintain the pipes, storage tanks, etc. (Purdin-NWWA)
W79-06724

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
For primary bibliographic entry see Field 5G.
W79-06735

EVALUATION OF TRENCHLESS SEWER CONSTRUCTION AT SOUTH BETHANY BEACH, DELAWARE,
Richardson (Edward H.) Associates, Inc., Newark, DE
L. J. Beetschen, and W. C. Henry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 776, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-022, March 1978. 94 p, 35 fig, 20 tab. S-800690.

Descriptors: *Sewers, *Construction, *Construction costs, *Construction materials, *Construction joints, Soil types, Water table, Cost comparisons, Trenches, Installation costs, Construction costs, Pipes, Pipelines.

A trenchless method of sewer construction was compared with conventional construction methods under similar site conditions. Cost comparisons were made on the basis of contract prices, calculated composite sewer systems, and man-day rate. The trenchless method proved to be more cost effective: 50% on the actual unit bid price; 16% on complete sewer installation including manholes, wyes, laterals; and 23% on labor. The conventional method used eight inch polyvinyl chloride pipe and rubber gasketed joints; the trenchless method used 8-inch polyvinyl chloride solvent welded pipe. Although the trenchless method does not seem suited for urban areas with significant subsurface utilities, or where rock or boulders appear in high density, it is adapted to high water table areas, and its application is flexible over a wide range of varying soil conditions. With proper field control it results in less deflection and horizontal and vertical misalignment; its potential for infiltration is small. This method is safer than the conventional one, because open trenching is reduced to a minimum. It is less disruptive to traffic, and is an improvement in sediment runoff control and noise reduction. (Davison-IPA)
W79-06783

RESIDUAL STRENGTH TEST, PARAITINGA AND PARAIBUNA DAMS, BRAZIL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavement Lab.
F. C. Townsend, and P. A. Gilbert.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 896, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper S-74-21, June 1974. 30 p, 16 fig, 2 tab, 1 append.

Descriptors: *Shear strength, *Soil properties, *Soil compaction, Laboratory tests, Soil mechanics, Dams, Stress, Foreign countries, Foreign research, Shear, *Paraitinga dam, *Paraibuna dam, *Brazil, Waterways experiment station.

Monotonic residual strength tests were conducted on micaceous material from Paraitinga and Paraibuna dams. The test program consisted of multistage annular shear tests on both loosely and densely compacted specimens from both dams under normal stresses of 1.1, 3.1, and 9.1 kg per sq cm. The test results showed that materials from the two dams are quite similar and can be classified as silty sands. The densities of the block samples from Paraitinga and Paraibuna dams were 88.6 and 92.6% maximum standard density from Harvard miniature compaction tests. (Singh-ISWS)
W79-06879

INVESTIGATION OF PLASTIC PIPE FOR USE BY THE CORPS OF ENGINEERS,
Construction Engineering Research Lab. (Army), Champaign, IL.
A. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 313, Price codes: A03 in paper copy, A01 in microfiche. Technical Report M-219, July 1977. 43 p, 4 fig, 13 tab, 12 ref, 4 append.

Descriptors: *Plastic pipes, *Pressure conduits, *Building codes, *Water hammer, Plumbing, Economics, Corrosion, Data collections, Water supply, Energy consumption, Drain-waste-vent.

This report presented the findings of a study of commercially available plastic pipe used for water distribution, plumbing, drain-waste-vent, and sewage systems. The study included a survey of military and civilian users of plastic pipe to determine acceptance, a review of model building codes and standards, and a testing program involving the making of joints under different conditions. Results of this study indicated that plastic pipe is an acceptable substitute for metallic pipe in many installations. Significant cost savings in both labor and material can be realized by using plastic pipes. The plastic pipes are available in a range of sizes and pressure ratings. Less energy is required in their production, and their corrosion resistance can produce additional cost savings. Good, serviceable joints can be made with proper use of the currently available methods. (Singh-ISWS)
W79-06880

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
M. R. Richard.
Water Well Journal, Vol. 33, No. 4, p 66-71, 74, April 1979.

Descriptors: *Water wells, *Drilling fluids, *Water pollution, Bacteria, Polymers, Rotary drilling, Sampling, Public health, Water wells, Disinfection.

A case study is presented of a water well driller who used Revert, an organic polymer drilling fluid. Bacterial contamination of wells drilled with this fluid was noticed after drilling over 50 wells. Efforts to correct the situation met with little success. The driller, unable to meet financial obligations since most of the wells were not approved by the local board of Health, filed bankruptcy and brought suit against the UOP Johnson Division which manufactures Revert. The driller may bear some responsibility for the contamination since he used hole cuttings containing Revert as grouting material, a practice which would tend to favor continued bacterial growth. (See also W79-06898) (Purdin-NWWA)
W79-06897

THE ORGANIC DRILLING FLUID CONTROVERSY: PART II,
M. R. Richard.
Water Well Journal, Vol. 33, No. 5, p. 50-58, May, 1979.

Descriptors: *Water wells, *Drilling, *Drilling fluids, *Polymers, Water pollution, Rotary drilling, Bentonite, Well regulations, Public health, Sampling, Bacteria.

Public health officials and water well drillers discuss their experiences and opinions concerning organic drilling fluids. Several states have regulations concerning their use or are in the process of investigating them. Many problems in organic-drilled wells may result from a driller's unsanitary drilling procedures or failure to follow manufacturer's instructions. Helpful suggestions are provided for safe and effective use of organic drilling fluids. If time and effort are spent on these precautions, organic drilling fluids can be a valuable tool, saving the driller much time and money and resulting in easier development and increased well yields. (See also W79-06897) (Purdin-NWWA)
W79-06898

ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL,
American Public Works Association, Chicago, IL.
R. H. Sullivan, R. S. Gemmell, L. A. Schafer, and W. D. Hurst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 738, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-77-017a, December 1977. 110 p, 17 fig, 13 tab, 17 ref. 803151.

Descriptors: *Sewers, *Sanitary sewers, *Economics, *Infiltration, *Inflow, *Root systems, *Gates, Repairing, Maintenance, Rehabilitation, Pipes, Inspection, On-site investigations, Cities, Joints(Connections).

A compilation of needed information for local uthorities and consulting engineers on the control nd elimination of infiltration/inflow (I/I) flows to anitary sewer systems is presented. The present ractices for determining and controlling I/I are dentified and analyzed, and the role of roots and de or backwater gates in the I/I problem is nvestigated. On-site investigations and question-aires revealed that local authorities were just be-inning to consider their I/I problems. It was ound that roots were a major sewer system prob-em. Tide gates, considered satisfactory, generally eceive infrequent maintenance and often do not lose properly. Since it is seldom cost-effective to orrect all points of infiltration and some types of nflow, only major conditions should be corrected efore determining the economics of rehabilitation ersus transport-treatment. Correction of inflow onditions is generally dependent upon the politi-al support of community leadership. Many of the actors important for economic analysis are specif-c to the site, and therefore the sample calculations eveloped herein should be used only as a guide. Vater conservation devices such as flow-reducing hower heads and lavatory fixtures may be cost-ffective when costs for the entire system are onsidered. This study updates a similar effort onducted in 1970. (Davison-IPA)
V79-06952

CONTROL OF SEWER OVERFLOWS BY POLYMER INJECTION,
Dallas Water Utilities Dept., TX.
R. W. Chandler, and W. R. Lewis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 654, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-189, 1977. 169 p, 47 fig, 16 ab, 53 ref, 5 append.

Descriptors: *Sewers, *Overflow, *Polymers, Flow characteristics, *On-site tests, Flow rates, Friction, Performance, Costs.

Certain water soluble chemicals were injected into ewers to reduce turbulent friction. The friction-educing chemicals prevented or limited overflows n a working sewer line when an automatic injec-ion system was used. Three methods of polymer eed control were studied: constant rate, flow pro-portional, and level proportional. Constant rate is he simplest and least expensive and was adequate nder most conditions. Polymer dosages directly rom the dry material were in the range of 15 to 50 ppm. These are lower dosages than previously sed; thus, polymer injection may be more eco-omical than previously believed. Two problems vhich limited the success of the method were nstrumentation failures and polymer lumping. Polymer lumping has been solved by redesigning he polymer feed funnel to incorporate a trap for umps. The two polymer types tested were: Union Carbide Polyox WSR-301 (polyethylene oxide) nd ICI America 4430 (polyacrylamide copo-ymer). Friction reducing properties were similar, ut differences in mixing properties existed. The CI polymer had a wetted specific gravity greater han 1.0, which produced some polymer accumula-ions near the bottom of the mixing tank. In this ase, mechanical agitation would make the injec-ion rate more constant. (Small-FRC)
V79-06973

SEWER INFILTRATION AND INFLOW CONTROL PRODUCT AND EQUIPMENT GUIDE,
American Public Works Association, Chicago, IL.
W. S. Foster, and R. H. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 680, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-017C, 1977. 78 p, 50 fig, 7 ref, 1 append.

Descriptors: *Sewerage, *Inflow, *Infiltration, Flow measurement, *Pipes, *Monitoring, Safety, Sanitary engineering, Inspection, Maintenance, Mechanical equipment.

New and existing equipment, materials, and prac-ices available to prevent the infiltration and inflow of water into sewer systems are listed and discussed. Sewer cleaning techniques and equipment needed to help locate points of infiltration and inflow and to improve the accuracy of inflow measurements, are described. A review is presented of the flow-measurement equipment and techniques necessary for the determination of the quantity of infiltration and inflow. Equipment and practices used to inspect sewers and locate entry points of unwanted water are also reviewed. These include closed-circuit television, photographic inspection, low-pressure air testing, and smoke inspection. Current sewer-grouting practices, equipment, and material are discussed with emphasis on acrylamide gel and the elastomeric grouting compound. A review is presented of insertion pipe for rehabilitation, sewer fittings, and a brief discussion of trench backfilling monitored by nuclear soil-density meters. Safety practice, which should be followed when crews undertake control of sewer infiltration and flow, are discussed. (Small-FRC)
W79-06980

8B. Hydraulics

A SUMMARY OF INTERACTING, SURFICIAL GEOLOGIC PROCESSES AND POTENTIAL GEOLOGIC HAZARDS IN THE NORTON BASIN, NORTHERN BERING SEA,
For primary bibliographic entry see Field 5B.
W79-06516

TWO-DIMENSIONAL SHALLOW WATER-WAVE MODELS,
Louisville Univ., KY. Dept. of Civil Engineering.
N. Katopodes, and T. Strelkoff.
Journal of Engineering Mechanics Division, American Society of Civil Engineers, Vol 105, No EM2, Proceedings Paper 14532, p 317-334, April 1979. 8 fig, 1 tab, 23 ref, 2 append.

Descriptors: *Waves(Water), *Shallow water, *Flood waves, *Model studies, Mathematical models, Equations, Unsteady flow, Flow, Numerical analysis, Analytical techniques, Hydraulics.

For two-dimensional unsteady flow in shallow water, real characteristic surfaces exist. Their envelope is a quadric conoid, whose curvilinear rays serve as paths for the transmission of information in t-x-y space. The original equations of flow can be reduced along these rays, called bicharacteristics, to equations containing differentiation in one less direction. Simplified numerical methods can be developed, utilizing this property of the equations, that are superior to both finite difference and finite element techniques. Three numerical characteristic networks of varying complexity were tested for accuracy and stability with flow problems that involve both subcritical and supercritical flow. The solution proceeds in specified time intervals by extending the bicharacteristics backwards until they intersect a plane on which the flow conditions can be found by interpolation from known data. The most accurate numerical network was applied to the computation of a highly two-dimensional wave propagating on a dry bed. (Sims-ISWS)
W79-06588

FRICTION FACTORS FOR CORRUGATED PLASTIC DRAINAGE PIPE,
Guelph Univ. (Ontario). School of Engineering.
R. W. Irwin, and J. Motycka.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14424, p 29-36, March 1979. 6 fig, 9 ref, 1 append.

Descriptors: *Pipe flow, *Plastic pipes, *Friction, Turbulent flow, Hydraulics, Plastics, Flow, Drainage, Turbulence, Graphical analysis, *Drainage pipes, Friction factors, Corrugated pipes.

The hydraulic roughness of 200-mm, 250-mm, and 300-mm corrugated plastic drainage pipe was measured. The Darcy-Weisbach friction factor and the Manning roughness factor, respectively, are as follows: 200 mm = 0.082 and 0.019; 250 mm = 0.068 and 0.018; and 300 mm = 0.095 and 0.022. A graph for pipe diameter selection for a choice of slopes was included. (Lee-ISWS)
W79-06608

FLOW PAST BODIES IN A TURBULENT FLOW NEAR A SOLID SURFACE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2J.
W79-06612

FLOW IN A BEND IN A ROTATING OPEN CHANNEL,
Bergen Univ. (Norway). Geophysical Inst.
G. K. Furns.
Journal of Hydraulic Research, Vol. 17, No. 1, p 15-22, 1979. 5 fig, 3 ref.

Descriptors: *Open channels, *Flow, *Hydraulics, Eddies, Viscosity, Coriolis force, Equations, Mathematical studies, Rotational flow, *Rotating open channel, Rossby number, Secondary flows.

A constant flow down a circular bend in a rotating open channel of rectangular cross-section was considered. By using the eddy viscosity concept combined with a finite slip velocity at the bed, simple analytical solutions of the problem were obtained. They showed a helical motion induced by the combined effects of channel curvature and Coriolis force. For values of the inverse Rossby number close to zero, we have the well known secondary flow away from the center of curvature near the surface and towards it near the bottom. As the inverse Rossby number increases, the secondary flow is strengthened or weakened, depending on the relative direction of rotation of the basic flow. The basic flow also was shown to be strongly influenced by the inverse Rossby number. (Lee-ISWS)
W79-06759

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 12, APPENDIX 16: HYDRAULIC MODEL TESTING,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 6G.
W79-06795

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1976 - 1977,
Department of Fisheries and Environment, Ottawa (Ontario).
B. C. Armstrong, and J. J. Cameron.
Economic and Technical Review Report EPS 3-WP-79-1, January 1979, 132 p.

Descriptors: *Bibliographies, *Environmental engineering, *Water, *Waste water(Pollution), *Air pollution, *Solid wastes, Utilities, *Environmental conditions, *Northern Areas.

To aid individuals concerned with or working on environmental engineering projects in northern areas, the Northern Technology Unit (NTU) has undertaken a program of preparing biennial bibliographies of environmental engineering reports and papers. This publication is the second in the series, the first of which was the 1974-75 edition, published March, 1977 as Environmental Protection Service Report No. EPS-3-WP-77-6. Only reports and papers which are generally available are included in either of these report listings. The NTU will not function as a distribution source for the reports listed in the bibliographies. There are three distinct parts to this document. The first, the annotated bibliography itself, has been arranged alphabetically by first author. The article summaries were either prepared by the NTU or extracted from published abstracts. The second part, the keyword index, is also in alphabetical order and was based on terms commonly used or appearing in similar engineering or environmental bibliographies. Included in the keyword index are special topic keywords relating to water, wastewater, air pollution, solid waste, environmental conditions

and utilities delivery to provide faster access to the references by subject area. The third part of the document is the special bibliography of conferences and other bibliographies which may be of interest to the user. This latter section was not limited to the 1976-77 period. (WATDOC)
W79-06847

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 6B.
W79-06855

8C. Hydraulic Machinery

WATER SYSTEMS BASICS--PART IV.
Ground Water Age, March, 1979. p 17-19, 3 fig, 3 tab.

Descriptors: *Pumps, *Electrical wiring, Jets, Submersibles, Installation.

Selection criteria for water pumps include cost, performance, noise, well depth and other advantages and disadvantages. Shallow-well jet, deep-well jet, and submersible pumps are compared using these criteria. Pump installers should make sure that overload protection is provided and that the wire from the control box to the pump is of adequate size. The size wire needed depends on the power requirements of the pump and the length of the wire run. A lightning arrester should be added if it is not included with the basic pump package. (Purdin-NWWA)
W79-06899

WATER SYSTEMS BASICS--PART V.
Ground Water Age, Vol. 13, No. 8, p 17-19, 36, April, 1979. 2 fig.

Descriptors: *Jets, Installation, Pumps, Shallow wells, Deep wells, Sites, Well data, Pipes, Pumping.

Basic procedures and guidelines for jet pump installation are outlined. The location for the jet pump should be stable, sanitary, protected, and as close to the well as possible. Well capacity and other data should be determined from a well log or pump test. The size of pipes, whether steel or plastic, should never be reduced below the pipe size of the ejector and the pump body. Essential pipe fittings include unions, gate valves, and tees. For shallow wells the maximum suction lift cannot exceed 25 feet. A foot valve prevents water in the suction pipe from flowing back into the well. A well seal is installed at the top of the casing. After surface connections are made the pump must be primed before operating. Deep well jet installation can be a two-pipe or single-pipe system. In the single pipe system, the casing acts as the drive pipe. Air pumping in underproductive wells can be avoided with a tailpipe which decreases the flow as the water level in the well falls. (Purdin-NWWA)
W79-06900

A COMPARISON BETWEEN EXPERIMENTAL AND NUMERICAL INVESTIGATIONS OF THE MOTION OF THE WATER SURFACE IN A MODEL SURGE TANK,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering.
P. W. France
Advances in Water Resources, Vol. 1, No. 1, p 49-51, September 1977. 3 fig, 4 ref.

Descriptors: *Surge tanks, *Motion, *Water surface, *Behavior, Comparison, Computer programs, Finite difference procedure, Unsteady flow, Equations, Hydroelectricity, Pipelines, Flow rate, Reynolds number

This paper describes an investigation into the motion of the water surface in a simple model surge tank and the relevant factors governing its behavior. The oscillation of the free water surface is an unsteady flow problem which is amenable to a mathematical solution using a finite difference step-by-step integration procedure. For comparison, two such methods are presented: (1) a simple initial value method; and (2) a predictor-corrector technique. Computer programs have been developed linked to a graph plotter to give a visual presentation of the numerical solutions together with the experimental results of the damped oscillation of the water surface in the model surge tank. (Bell Graf-Cornell)
W79-06923

8E. Rock Mechanics and Geology

HYDROGEOLOGICAL TESTING ASSOCIATED WITH UNDERGROUND COAL GASIFICATION,
Alberta Research Council, Edmonton. Ground Water Div.
R. I. J. Vogwill.
Canadian Geotechnical Journal, Vol. 16, No. 2, p 59-68, February, 1979. 7 fig, 2 tab, 9 ref.

Descriptors: *Coals, *Aquifer testing, Aquifer characteristics, Permeability, Storage coefficients, Anisotropy, Confined aquifers, Fracture permeability, Canada.

Four aquifer tests were conducted near Forestburg, Alberta to determine aquifer characteristics of a coal seam and surrounding sediment, examine surface-groundwater relationships, and establish whether the permeability of the coal seam was anisotropic. The results of these tests were to aid in the evaluation of the effects of underground coal gasification on the groundwater regime. Two pregasification tests indicated that the coal seam was a confined aquifer with a small storage coefficient and limited, anisotropic permeability that appeared to be unrelated to regional fracture patterns. The influence of this anisotropy on controlling the directions of gasification was not established due to uncertainty about the consistency of coal fracturing. The first post-gasification aquifer test indicated that the groundwater regime had changed somewhat. Groundwater temperatures increased from 6 degrees C to 30 degrees C. Permeability increased and had a more pronounced anistropy. Gasification was thought to have increased the porosity of the coal which resulted in a 20-fold increase in the storage coefficient. Subsequent excavation of the coal confirmed this assumption. The second post-gasification test indicated that fracturing in the coal seam was inconsistent and that major axis of anisotropy and the direction of regional major fracturing coincide. (Purdin-NWWA)
W79-06806

8G. Materials

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
For primary bibliographic entry see Field 8A.
W79-06897

8I. Fisheries Engineering

DISTRIBUTION OF INSHORE FISHES AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06886

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

U.N. GROUND WATER PROGRAM.
Water Well Journal, Vol. 33, No. 6, p 68, June, 1979.

Descriptors: *United Nations, *Foreign countries, *Water supply development, Ground water, Projects, Programs, Training, Exploration, Drilling, Governments, Research and development, Water resources development, Geologic formations, Geographic regions.

The U.N. ground water exploration and development program has substantially benefited 57 developing countries by improving rural and urban economies, increasing agricultural production and alleviating water shortages. Current projects include surveys of ground water resources, organization of ground water services, and water resources policy and planning. These projects are designed to satisfy a variety of water supply needs in different geographic and geologic areas. Financial and human resources contributed to the project by the host government are commensurate with the country's economy. Most U.N. projects have included on-the-job training using a variety of drilling rigs, and analytical and surveying equipment. (Purdin-NWWA)
W79-06707

9C. Research Facilities

RESULTS OF LYSIMETER TRIALS AT THE LIMBURGERHOF FACILITY 1927-1977; THE MOST IMPORTANT FINDINGS FROM 50 YEARS OF EXPERIMENTS,
Badische Anilin-und Soda Fabrik A.G., Ludwigshafen am Rhein (Germany, F.R.). Landwirtschaftliche Versuchsstation.
For primary bibliographic entry see Field 2G.
W79-06746

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

HYDROLOGY OF LAKES IN THE MINNEAPOLIS-SAINT PAUL METROPOLITAN AREA: A SUMMARY OF AVAILABLE DATA STORED--USING A DATA-BASE MANAGEMENT SYSTEM,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2H.
W79-06815

10C. Secondary Publication And Distribution

ANNOTATED BIBLIOGRAPHY FOR WATER QUALITY MANAGEMENT, FIFTH EDITION.
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06715

THIRD ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS (NO. 1293-2246),
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5C.
W79-06866

10D. Specialized Information Center Services

IRRIGATION DATA BASE FOR ARIZONA,
Sandia Labs., Albuquerque, NM.
For primary bibliographic entry see Field 6B.
W79-06564

NTERNATIONAL FIELD YEAR FOR THE REAT LAKES.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-282 462, rice codes: A07 in paper copy, A01 in microfiche. eport No. IFYGL Bulletin (Special) No. 22, larch, 1978. Proceedings, IFYGL Wrap-Up Vorkshop, Geneva Park Conference Centre, ongford Mills, Ontario, Canada, October 2-5, 977, 150 p, 13 fig, 1 tab, 349 ref, 4 append.

escriptors: *International Hydrological Decade, Conferences, *Lake Ontario, *Canada, Water balnce, Lake morphology, Boundaries(Surfaces), ir-water interfaces, Turbulent boundary layers, nergy budget, Meteorology, Evaporation, Biolgy, Chemistry, Lake basins, Watersheds(Basins).

wrap-up workshop was attended by 61 scientists ho participated in or contributed to the Internaonal Field Year for the Great Lakes, a joint U.S.-anadian field study of Lake Ontario and its basin. he panel discussions were organized to critically ssess the following programs: terrestrial water alance, lake meteorology, atmospheric boundary yer, energy balance, evaporation synthesis, water ovements, and biology and chemistry. The reorts vary as to content and emphasis because each anel had a slightly different interpretation of its ole. (Davison-IPA)
779-06874

0F. Preparation Of Reviews

ROUND-WATER COMPUTER MODELS--TATE OF THE ART,
amp, Dresser and McKee, Inc., Champaign, IL. Vater Resources Div.
or primary bibliographic entry see Field 2F.
779-06595

SPECIAL REPORT: GROUND WATER INUSTRY LEADERS.
round Water Age, p 34-51, December, 1978.

escriptors: *Water wells, *Surveys, *Drillers, Water systems, Gross income, Industries, Personel.

survey of the ground water industry's leaders in e United States ranks leading contractors, wholelers, and water system specialists by dollar olume. Key personnel, major equipment owned, ells drilled, pumps installed and major areas of ctivity are listed. Wholesaler listings include ajor water systems product lines and gross olume. All firms were asked the same survey uestions. Some, however, elected not to answer ne or more of the questions such as annual gross ollar volume. Some firms preferred not to be cluded in the survey. (Purdin-NWWA)
779-06706

IL/WATER SEPARATION: STATE-OF-THERT,
utgers - the State Univ., New Brunswick, NJ. epT. of Chemical and Biochemical Engineering.
or primary bibliographic entry see Field 5D.
779-06775

ROCEEDINGS OF THE BI-STATE CONFERNCE ON THE CHESAPEAKE BAY APRIL 27-, 1977,
or primary bibliographic entry see Field 6B.
779-06778

ROCEEDINGS, FIFTH UNITED STATES/APAN CONFERENCE ON SEWAGE TREATIENT TECHNOLOGY,
nvironmental Research Center, Cincinnati, OH.
or primary bibliographic entry see Field 5D.
779-06779

HORELINES MANAGEMENT '77: PERORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Resources.
For primary bibliographic entry see Field 6G.
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BIOLOGICAL IMPLICATIONS OF METALS IN THE ENVIRONMENT.
For primary bibliographic entry see Field 5B.
W79-06787

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Environmental Assessment of the Alaskan Continental Shelf. Quarterly Reports of Principal Investigators July - September 1978, Volume I.
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- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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SELECTED WATER RESOURCES ABSTRACTS

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AUGUST 1, 1979

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The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

DETERMINATION OF SULFATE IN SEAWATER AND NATURAL BRINES BY 133BA AND MEMBRANE DIALYSIS,
Geological Survey, Menlo Park, CA.
R. J. Rosenbauer, J. L. Bischoff, and W. E. Seyfried.
Limnology and Oceanography, Vol. 24, No. 2, p 393-396, March 1979. 2 tab, 11 ref.

Descriptors: *Sea water, *Water properties, *Methodology, *Sulfates, Laboratory tests, Chemical properties, Instrumentation, Salinity, Analytical techniques, Analysis, Radiochemical analysis, Barium, Radioisotopes, Membrane processes, Dialysis, Measurement, Brines.

Dissolved sulfate is determined by precipitation with the radioisotope 133Ba and counting of the precipitate on a scintillation counter. Precipitation is carried out in dialysis bags; excess 133Ba is removed via diffusion by soaking the bags in distilled water for 12 h, and the bags are then placed directly in the well of the scintillation counter. The procedure eliminates previous errors caused by washing and transferring of the precipitate and permits analysis of 0.5-3,000 microgram/ml sulfate in a 1.0-ml sample. The detection limit is increased by simply increasing the sample volume up to 5.0 ml. The technique is interference-free in natural waters ranging from freshwater to brines of 1.5 times the salinity of seawater. (Humphreys-ISWS)
W79-07056

THE DENSITY AND SPEED OF SOUND OF ORCA BASIN WATERS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
F. J. Millero, A. L. Surdo, P. Chetirkin, and N. L. Guinasso, Jr.
Limnology and Oceanography, Vol. 24, No. 2, p 218-225, March 1979. 3 fig, 8 tab, 18 ref. ONR N00014-75-0173, NSF CE73-00351-A01, NSF OCE 77-21009, ONR N00014-75-0537.

Descriptors: *Sea water, *Water properties, *Laboratory tests, *Gulf of Mexico, Salinity, Acoustics, Density, Water temperature, Water sampling, Evaporation, Analysis, Analytical techniques, Saline water, Brines, Conductivity.

The composition of samples of waters collected in the Orca depression (Gulf of Mexico) above and below the seawater-brine interface was characterized by measuring chlorinity (Cl) and salinity (S). The ratio of S:Cl = 1.6823 in the brines, compared with 1.6817 calculated from composition data. Densities and sound speeds of the waters were measured at 15C, 25C, and 35C and the results were fitted to chlorinity functions. The standard deviations in density are approximately 0.000060 g/cu m, in sound speed approximately 1.2 m/s. These standard errors are about 6 times larger than the precision of the measurements and are due to errors in determining Cl and to changes in the brine composition across the interface. Conductivity, density, and sound speed were measured in weight-diluted brine samples, and the results were used to calculate the relationship of evaporation salinity to salinity calculated from measurements on standard seawater. The differences in evaporation salinity and S determined from properties of standard seawater are caused by hydration changes in the major constituents. The measured brine densities were compared with values calculated by using an additivity method and the known composition of the waters and agreed to within + or - 0.000280 g/cu m over the temperature range measured. (Humphreys-ISWS)
W79-07145

MAGNETIC WATER CONDITIONERS: ARE THEY FOR REAL,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5F.
W79-07194

1B. Aqueous Solutions and Suspensions

THE EFFECT OF NEUTRALIZATION OF THE ANAESTHETIC MS 222 ON FRESHWATER QUALITY,
Randes Afrikaanse Univ., Johannesburg (South Africa). Dept. of Zoology.
G. L. Smit, P. S. J. Halliday, and J. Hattingh.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 31-34, July 1978. 1 fig, 3 tab, 6 ref.

Descriptors: *Fresh water, *Water quality, *Anesthetic, *Neutralization, Alkalinity, Hydrogen ion concentration, Ammonia, Calcium, Sulfate, Nitrogen, Hardness, Water types, Conductivity.

The quality of fresh water with different mineral contents was studied with regard to the long and short term effects of the fish anesthetic Tricaine methanesulphonate (MS 222) and the effect of neutralizing this anesthetic with NaOH. Varying concentrations of MS 222 were dissolved in distilled water and titrated against equimolar solutions of NaOH to a pH beyond the neutral point of the solute. Concentrations of MS 222 were added to aged tapwater, borehole water and distilled water. Values were measured in duplicate for pH, pO2, pCO2, alkalinity, calcium hardness, sulfate, nitrogen, and chloride. The results indicate the MS 222, acidic in nature, causes changes in pH, pCO2, alkalinity, and calcium hardness levels in tapwater and borehole water. Conductivity and pH changes were shown in distilled water; borehole water conductivity was not affected. Conductivity increased in tapwater with increased MS 222 concentrations. Neutralization of MS 222 prevents any changes, except for conductivity, in these parameters. It is suggested that neutralization produces a safer, more effective anesthetic. (Davison-IPA)
W79-07185

2. WATER CYCLE

2A. General

DETERMINISTIC-SYSTEMIC RELATIONSHIPS IN OVERLAND FLOW ANALYSIS,
University of Southern California, Los Angeles. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-07115

HYDROLOGY AND CHEMICAL QUALITY OF FLOW FROM SMALL PASTURED WATERSHEDS: I. HYDROLOGY,
Ohio Agriculture Research and Development Center, Wooster.
R. W. Van Keuren, J. L. McGuinness, and F. W. Chichester.
Journal of Environmental Quality, Vol. 8, No. 2, p 162-166, April-June 1979. 2 fig, 5 tab, 13 ref.

Descriptors: *Hydrology, *Agricultural watersheds, *Water balance, *On-site investigations, *Ohio, Surface runoff, Demonstration watersheds, Pastures, Small watersheds, Precipitation(Atmospheric), Soil moisture, Evapotranspiration, Subsurface flow, Soil erosion, On-site data collections, Pasture management, Grazing, Seasonal.

Surface runoff, soil loss, and subsurface flow were measured from 4 rotationally grazed summer pastures. One of these pastures was also used as a winter-feeding area. Surface runoff volumes and peak rates from the 3 pastures used only for summer grazing were generally less as compared with values for earlier years when the fields were in meadow and light pasturing; however, runoff from the winter-feeding area was markedly increased. Both before and after the initiation of grazing, the areas used only for summer grazing had but a trace of soil loss. More soil was lost from the winter-feeding area, particularly during the dormant season. Water-balance studies indicated that during the growing season, surface runoff and subsurface outflow were higher and evapotranspiration (ET) was less from the winter-feeding area than from areas summer-grazed only. During the dormant season, surface runoff was higher and subsurface outflow was lower from the winter-feeding area than from the summer-grazed areas, whereas ET was similar. (See also W79-07133) (Humphreys-ISWS)
W79-07132

HYDROLOGY AND CHEMICAL QUALITY OF FLOW FROM SMALL PASTURED WATERSHEDS: II. CHEMICAL QUALITY,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
For primary bibliographic entry see Field 5B.
W79-07133

ESTIMATE DETENTION RESERVOIR STORAGE,
A. S. Paintal.
Water and Wastes Engineering, Vol. 16, No. 5, p 98-99, May 1979. 3 fig.

Descriptors: *Detention reservoirs, *Storage requirements, *Mathematical models, *Storm runoff, Reservoir storage, Hydrograph analysis, Rainfall intensity, Model studies, Time of concentration, Design, Routing, Estimating equations, Inflow, Surface runoff, Analytical techniques.

A simplified procedure was presented for estimating detention reservoir storage as governed by the characteristics of drainage area and the maximum allowable outflow rate. The models presented are based upon the following assumptions: (1) The rainfall intensity-duration relationship can be expressed as $I = a/(b + T)$ where I is rainfall intensity, in/hr, a and b are constants, and T is duration of rainfall in minutes; (2) The storms with durations longer than the time of concentration, t, for the drainage area produce larger volumes of run-off even though the peak flow rates are reduced; (3) The inflow hydrograph was taken to be of trapezoidal form and, the peak rate of run-off is given by the rational formula; (4) The rising and receding limbs of inflow hydrograph are equal to the time of concentration t; (5) The area under the inflow hydrograph represents the total volume of storm run-off and is equal to the peak rate of run-off multiplied by the storm duration. (Humphreys-ISWS)
W79-07136

WETLAND PROTECTION IN COMPLIANCE WITH NEPA,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07238

QUANTITATIVE MORPHOLOGY OF LANDFORMS IN CARBONATE ROCK BASINS IN THE APPALACHIAN HIGHLANDS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
E. L. White, and W. B. White.
Geological Society of America Bulletin, Pt. I, V. 90, p 385-396, April 1979. 12 fig, 6 tab, 30 ref. OWRT B-046-PA (4), 14-31-001-3638.

Descriptors: *Karst, Topography, Carbonate rocks, *Drainage basins, Dolomite, Calcite, Caves, Groundwater, Streamflow, Limestones, Aquifers, Sediment load, Applachian Highlands, Dolines, Sinkholes, Clastic rocks, Catchments, Ordovician carbonate rocks.

Karst topography occurs in the Appalachian Highlands where carbonate rocks are exposed. The principal landforms are sinking streams, dolines, and caves. Landform measures were devised for the drainage features and for dolines and applied to 62 small basins between Pennsylvania and Ala-

bama. Karst measures included carbonate rock fractions, measures of doline development, and measures of internal drainage. Factor analysis showed that the 15 measures contained only five independent variables. Various stream length measures are related to the basin area in much the same way as streams in noncarbonate basins showing the fluviokarst character of the Appalachian basins. Sinking stream length, SINKL, relates to the area of the sinking stream catchment, AB, by SINKL = 2.29 AB0.85. Doline karst was measured by either the area of internal drainage into dolines, AD, or by the number of dolines, N, per unit area of carbonate rock. These measures are related by AD = 0.0136 N1.17. The frequency of occurrence of dolines falls off exponentially with depth independent of rock type or structural setting. Comparison of several measures of karst in relation to rock type shows smallest and fewest dolines in the Ordovician dolomites and an intermediate size and number in the Ordovician limestones. The largest and most numerous dolines occur in the flat-lying Mississippian limestones of the Applachian Plateau. This result may be an expression of the more sluggish solution kinetics of dolomite compared to calcite. (Tsong-Penn State)
W79-07252

HYDROGRAPHIC PROJECT,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
N. P. Smith, J. Evans, and W. MacNaughton.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 2-1 - 2-130, January 15, 1979. 84 fig, 5 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Hydrography, *Seasonal, *Variability, Environmental effects, Resources development, Texas, *Outer Continental Shelf, *Current measurements, Petroleum development, South Texas Outer Continental Shelf(STOCS).

Recording current meter data from two field experiments, and hydrographic data from nine nearly synoptic cruises over the South Texas Outer Continental Shelf were used to describe the annual progression of physical oceanographic variables for 1977, and to infer the dominant time scales and external forcing mechanisms. Current measurements revealed a strong longshore transport to the south-southwest during the winter months and little net transport during the summer. Surface temperature data indicated a transition from strong cross-shelf gradients in the winter to nearly isothermal conditions in summer. Salinity variations were largely restricted to the transient decrease produced by the spring runoff. The principal external forcing mechanisms appeared to be the winter cold fronts, the spring runoff and summer heating. (See also W79-07287) (Sinha-OEIS)
W79-07289

RESULTS OF A JOINT U.S.A./U.S.S.R. HYDRODYNAMIC AND TRANSPORT MODELING PROJECT,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
J. F. Paul, W. L. Richardson, A. B. Gorstko, and A. A. Matveyev.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 516, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-79-015, February 1979. 101 p, 44 fig, 10 tab, 23 ref, 1 append.

Descriptors: *Hydrodynamics, *Mathematical models, *Sea of Azov(U.S.S.R.), *Lake Baikal(U.S.S.R.), *Saginaw Bay(Michigan), Equations, Mass, Conservation, Energy, Momentum equation, Methodology.

As part of the U.S.A./U.S.S.R. Agreement on Cooperation in the Field of Environmental Protection, a joint modeling project involving scientists from both countries was accomplished. Three geographical areas were investigated: Lake Baikal and the Sea of Azov in the U.S.S.R. and Saginaw Bay, Lake Huron in the U.S. The three modeling approaches were: (1) hydrodynamic modeling using conservation equations for mass, energy, and momentum; (2) transport modeling using mass construction (type 1); and (3) transport modeling using conservation of material and water mass as applied to Saginaw Bay (type 2). A general background summary of each of the three bodies of water is followed by a synopsis of the mathematical models. Applications of the models are presented. Comparisons with available data showed reasonable agreement. The hydrodynamic model calculation for the Sea of Azov is potentially useful in assessing the effects of hydrologic modifications. It is concluded that the work accomplished is a preliminary step in comprehensive comparison of the modeling methodology in the two countries among researchers for hydrodynamic and biochemical modeling. (Davison-IPA)
W79-07367

SIMULATION OF THE URBAN RUNOFF PROCESS,
Snowy Mountains Engineering Corp., Canberra (Australia).
For primary bibliographic entry see Field 6A.
W79-07376

PUBLIC DRAINAGE ATLAS, BLUE EARTH COUNTY, MINNESOTA,
Mankato State Univ., MN. Dept. of Biology.
L. Dunsmore, and H. W. Quade.
Availability: Biology Department, M.S.U., Mankato, MN 56001. Limnological Contribution No. 6, April 1979. 69 p, 5 fig, 18 tab. OWRT A-040-MINN (2).

Descriptors: *Drainage, *Watersheds(Basins), *Drainage systems, *Ditches, *Blue Earth County(Minnesota), *Basic data collections, *Mapping, *Maps, *Topographical mapping, Data collections, Minnesota Land Management Information System, Planning.

An atlas has been developed as a preliminary part of a data base for research and computer simulation modeling of drainage in south central Minnesota. A list of all ditches built in Blue Earth County was compiled, prints were microfilmed from ditch maps found in the county court house, and the individual prints were superimposed on seven and one-half minute United States Geological Survey (U.S.G.S.) Topographic Maps. Tracings were made from original maps for ditches not on microfilm, and then superimposed onto the topographical maps. Ditchsheds, riversheds, and lakesheds were determined by relief variations in U.S.G.S. topographical maps for more accurate depictions of true surface hydrology. Tracings were made from the U.S.G.S. maps and then planimetered. The individual township maps and planimetered data were aggregated to obtain the Blue Earth County Composite Map and data base. To compare present surface hydrology to preagricultural conditions in the county enlarged prints of each Congressional Township were obtained from microfilm copies of the 1860 General Land Survey, and the areas of lakes and swamps were traced and planimetered. The Minnesota Land Management Information System (MLMIS) variables of land use, soil landscape unit, geomorphic region and water orientation are to be used in the final simulation of drainage ditches and water quality. (Davison-IPA)
W79-07420

THE WATER BALANCE OF MOSCOW,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
M. I. Lvovich, and G. M. Chernogaeva.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 48-51, 1977. 1 tab, 5 ref.

Descriptors: *Water balance, *Urbanization, *Effects, *Hydrological cycle, *Environment, *Moscow(USSR), River basins, Hydrologic data, Seasonal, Change, Urban areas, Rural areas, Rainfall, Runoff.

The results of water balance estimates are given for the entire Moscow area as well as for the most built-up part within the Sadovoye ring, and the technique of estimation is presented. Water balance data for the urban area are compared with those for the natural Moscow River basin to Zvenigorod. Conclusions are drawn concerning the effect of changes in the water balance of an urban area on the environment. (See also W79-07426) (Bell Graf-Cornell)
W79-07432

EXPERIMENTAL STUDIES OF CHANGES IN THE WATER BALANCE OF AN URBAN AREA,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
M. I. Lvovich, and E. P. Chernishov.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 63-67, 1977. 1 fig, 1 tab, 8 ref.

Descriptors: *Water balance, *Urbanization, *Effects, *Surface runoff, *Water pollution, Industries, Water resources, Land use, Catchments, Precipitation, Hydrologic cycle, Economic development, Change.

The Institute of Geography of the USSR Academy of Sciences, Moscow, has been conducting studies on water balance changes under urban influences and industrial agglomerations in Kursk. This is a city typical of the European part of the USSR with a population of 300,000. It is one of the economic and cultural centres of the foreststeppe zone. The results of observations on the water balance elements of the urban area are compared with data from earlier similar studies conducted near Kursk in the virgin area of the Central Chernozem Reserve and also on arable land. As a result of these studies, seasonal and yearly water balances were made for the urban area and the water balance changes were estimated. The research is based on a method adopted by the Institute of Geography. (See also W79-07426) (Bell Graf-Cornell)
W79-07435

HORIZONTAL DIVISION OF THE HYDROLOGICAL MODELS FOR A BASIN WITH MAN-MADE INFLUENCES, PARTICULARLY OF URBANIZATION,
Technische Univ., Dresden (German, D.R.). Dept. of Hydrology and Meteorology.
N. Hansel.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 68-78, 1977. 3 fig, 5 tab, 28 ref.

Descriptors: *Hydrologic models, *River basins, *Urbanization, *Effects, *Horizontal division, Man-made influences, Runoff, Methodology, Hydrologic data, Systems analysis.

The problems of the horizontal division of a hydrological model for a catchment with man-made influences are shown for examples of urbanization. A consideration of the possibilities of the horizontal division in using models for basins with man-made influences gives results for the structure of models. Data from three catchments verify the results. The influence of urbanization and industrialization is considerable in these catchments. (See also W79-07426) (Bell Graf-Cornell)
W79-07436

WATER BUDGET FOR A HOUSING AREA IN GOTEBORG,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
For primary bibliographic entry see Field 5B.
W79-07440

SOME QUALITATIVE AND QUANTITATIVE ASPECTS OF SURFACE WATER IN AN URBAN AREA WITH SEPARATE STORM WATER AND WASTE WATER SEWER SYSTEMS,
Rijksdienst voor de Ijesselmeerpolders, Lelystad (Netherlands).
J. A. van den Berg, J. de Jong, and E. Schultz.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 109-123, 1977. 9 fig, 8 tab, 11 ref.

Descriptors: *Surface waters, *Storm water, *Waste water(Pollution), *Sewer systems, *Water quality, *Water quantity, *Digital model, *Nonsteady flow, *Open drains, *Runoff coefficients, *Rainfall, Subsurface waters, Precipitation, Storm drains, Hydrologic data, Discharge(Water), Catchment areas, Outflow, Design, Culverts, Weirs, Measurement, Nash model, Loss distribution, Regression analysis, Equations, Mathematical models, Systems analysis.

A part of the flat urban area (116 ha) of the new town of Lelystad, situated in a recently reclaimed polder in the former Zuiderzee, was the subject of a study on the flow of surface and subsurface water into and through open drains. Precipitation, discharge of storm drains and of subsurface drainage were measured in three catchment areas. From these data, the runoff coefficients and the transformation of the rainfall into outflow from the storm water drains are calculated. These outputs are used for modeling the nonsteady flow through the open drains. This model is applied in the design of urban system open drains, culverts, and weirs. The water quality of the system has also been investigated. From the measurements, it can be concluded that the system of separate storm and waste water sewers produces less water pollution than a combined system with zero overflows. (See also W79-07426) (Bell Graf-Cornell)
W79-07441

CALCULATION OF INSTANTANEOUS UNIT HYDROGRAPHS IN AN URBAN AREA,
Technische Hogeschool, Delft (Netherlands).
P. van der Kloet, M. van der Wal, and J. G. Zondervan.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 124-143, 1977. 10 fig, 3 tab, 11 ref.

Descriptors: *Unit hydrographs, *Model studies, *Rainfall-runoff relationships, *Simulation analysis, *Parametric hydrology, *Urban areas, *Catchment areas, Hydrologic data, Sewers, Optimization, Storm water, Overflow, Equations, Systems analysis, Impervious cover, Nash model, Fourier analysis, Laguerre functions, Quadratic programming, Linear time-discrete model, The Netherlands.

This paper deals with a parameter identification problem for the rainfall-runoff relationship in an urban area. Unit hydrographs have been calculated for areas with different percentages of impervious cover with the aid of measured rainfall and runoff. Two case studies are reported: (1) a sewer district in Enschede with low quality data and (2) some specially equipped catchment areas with high quality in Lelystad, a new town in one of the IJesselmeer polders. These catchment areas include a parking lot, a residential quarter and a shopping center. In the first study, one method, based on Laguerre functions, was applied to calculate unit hydrographs. Four methods were used in the second study and the provisional results compared. First, the Nash cascade was chosen as a model for the rainfall-runoff relationship. The parameters n and k were calculated by moments. Next, some exercises were made with the Fourier transform method. The Nash cascade can be expanded with Laguerre functions. The last method concerns quadratic programming, which minimizes the difference between computed and recorded runoff in the sense of least squares. Besides the influence of the distribution of the losses on the unit hydrograph, the different unit hydrographs have been illustrated for the catchment areas. Finally, as the last stage of modeling, a start has been made in validating the identification methods by the calculation of correlation coefficients. (See also W79-07426) (Bell Graf-Cornell)
W79-07442

RUNOFF CONTROL ON URBANIZING CATCHMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. Marsalek.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 153-161, 1977. 2 fig, 2 tab, 10 ref.

Descriptors: *Urban runoff, *Urban drainage, *Runoff control, *Catchments, *Methodology, *Simulation analysis, Evaluation, Measurement, Design storm, Historical storms, Effects, Size, Imperviousness, Frequency, Hydrologic data, Rainfall-runoff relationships, On-site detention, Mathematical models, Systems analysis.

Recent urban drainage policies frequently stipulate the requirement of zero increase in the runoff peak flow due to the catchment development. Since runoff measurements for either of the catchment states are rarely available, urban runoff models must be used to simulate runoff and to design runoff control measures to meet the policy requirements. A methodology for evaluation of runoff and runoff control measures is demonstrated on an urban test catchment for which extensive rainfall-runoff measurements are available for a postdevelopment stage. These measurements were used to calibrate the Storm Water Management Model of the US Environmental Protection Agency. The model was then used to simulate runoff for the predevelopment stage, the existing stage, and a newly proposed low cost residential development. The simulations were made for historical and design storms of various frequencies. Runoff peaks produced by design storms were up to twice as large as those produced by historical storms of identical frequencies. The volumes of detention storage necessary to maintain the predevelopment runoff peaks were calculated for events of various frequencies of occurrence. Effects of the size and imperviousness of the urbanizing catchment were detected. (See also W79-07426) (Bell Graf-Cornell)
W79-07444

2B. Precipitation

ALUMINUM LEACHING RESPONSE TO ACID PRECIPITATION: EFFECTS ON HIGH-ELEVATION WATERSHEDS IN THE NORTHEAST,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2K.
W79-07103

RAINFALL ADDITAMENTS TO SUBSURFACE WATER IN A YOUNG PINE PLANTATION,
West Virginia Univ., Morgantown. Div. of Forestry.
For primary bibliographic entry see Field 2I.
W79-07117

CHARACTERISTICS OF OKLAHOMA HAILFALLS AND HAILSTORMS,
National Severe Storms Lab., Norman, OK.
S. P. Nelson, and S. K. Young.
Journal of Applied Meteorology, Vol. 36, No. 3, p 339-347, March 1979. 6 fig, 7 tab, 26 ref.

Descriptors: *Precipitation(Atmospheric), *Hail, *Storms, *Oklahoma, On-site investigations, Data processing, Weather, Thunderstorms, Rainfall, Winds, Meteorology, Hailfalls, Hailstorms, Severe storms.

Data on point and areal (100-8100 sq km) surface hailfall characteristics were presented for Oklahoma. Data analysis showed that Oklahoma experiences a larger mean hailstone per occurrence than South Africa and a larger mean hailfall area than South Africa or Illinois. Further investigations were made into the parent hailstorms. They were first subdivided using the ordinary/supercell classification system suggested by Browning. The classification system was found to have general utility for central Oklahoma when applied to all observed hailstorms that occurred within an 8100 sq km area over a four-year period. Supercells comprised about 25% of the storms and had a larger mean observed hailstone diameter (4.4 cm) and a larger mean maximum swath width (18.1 km) than the ordinary cell storms (mean value of 1.4 cm and 8.1 km, respectively). These differences in hail production were significant at the 1% level. (Sims-ISWS)
W79-07138

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07250

A TECHNIQUE FOR THE DETERMINATION OF AREAL AVERAGE RAINFALL,
Mosul Univ. (Iraq). Coll. of Engineering.
B. B. Lal Pande, and G. Al-Mashidani.
Hydrological Sciences Bulletin, Vol. 23, No. 4, p 445-453, December 1978. 6 fig, 6 tab, 7 ref.

Descriptors: *Rainfall, *Areal, *Precipitation(Atmospheric), Average, Technology, Rain gages, Basins, Isohytes, Gaging stations, Mathematical studies, *Areal average rainfall, *Hypothetical basins, Techniques, Arithmetic mean, Thiessen polygon, Isohyetal method, Basin relief.

A method was developed for allocating an area likely to be shared by a raingage station. Average areal precipitation was found by weighting the rainfall at the gaging station in terms of the product of distances enclosing it or radiating from it. The method was applied to 2 real and 2 hypothetical basins, and the results were compared with those obtained by existing techniques. This method of determining average rainfall is based on reasonable assumptions. If the weight to be given to a particular station is estimated in terms of the product of distances instead of actually measuring the area, the method becomes faster and gives reasonable results. (Roberts-ISWS)
W79-07310

ACID RAIN: NEUTRALIZATION WITHIN THE HUBBARD BROOK ECOSYSTEM AND REGIONAL IMPLICATIONS,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W79-07311

SOME ASPECTS OF THE EFFECTS OF URBAN DEVELOPMENT ON THUNDERSTORMS IN THE SOUTHEAST COASTAL PLAIN OF GEORGIA, USA,
Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering.
A. U. Sorman.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 3-11, 1977. 3 fig, 4 tab, 16 ref.

Descriptors: *Effects, *Urban development, *Thunderstorms, *Georgia, *Rainfall, Distribution, Watersheds(Basins), Hydrologic data, Raincells, Summer, Networks, Raingauges, Evaluation, Stochastic processes, Estimating, Equations, Math-

ematical models, Systems analysis, Correlation coefficient.

This research is intended to show the effect of a newly-developed urban area on heavy rainfall distribution as well as to ascertain to what extent the urbanization of part of an experimental basin affects the temporal and spatial distribution of raincells. The study employed an analysis of storm data collected during the summers of 1968-1970. The Little River Experimental Watershed, located near Tifton, Georgia is monitored by a dense network of raingauges covering an area of 650 km2. The results obtained from graphical plots indicated that summer thunderstorms with a precipitation depth of 25 mm or more were initiated earlier on an urban area compared to the surrounding rural area. The frequency of storm occurrences from the year of urbanization and the areal depth of rainfall on the urban area increased with increase of storm depth. Finally, the transformation factor--the mean correlation coefficient--converting point rainfall into areal rainfall was determined in terms of storm area and characteristic distance parameter. The ratio da/do increased with an increase of storm center urban depths from 5 mm to 30 mm or more on the urban area, but it remained constant over the nonurban area. The results from the model study confirm the findings of similar studies carried out recently in this field of research. (See also W79-07426) (Bell Graf-Cornell)
W79-07427

URBAN EFFECTS ON STORM RAINFALL IN MIDWESTERN UNITED STATES,
Illinois State Water Survey. Urbana.
F. A. Huff.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 12-19, 1977. 2 fig, 4 tab, 6 ref.

Descriptors: *Storms, *Rainfall, *Midwestern U.S., *Urban effects, Missouri, Summer, Regional analysis, Networks, Water yield, Computer programs, Hydrology, Seasonal, Comparison, Radar analyses, Industries.

A comprehensive 5-year field and analysis program concerned with urban-induced effects on precipitation was recently completed at St. Louis, Missouri. Data obtained from operation of a network of 225 recording raingauges on 5200 km indicated an increase of approximately 30 percent in summer rainfall in an area which is most frequently exposed to storms crossing the urban-industrial region. This enhancement was most pronounced in heavy rainstorms that produced maxima of 25 mm or more in the network. The average water yield from individual raincells in these storms was over 70 percent greater in urban-exposed cells than in surrounding rural cells. Radar data showed a strong tendency for new raincells to form or for existing cells to intensify over the urban area. This cell enhancement was most pronounced with organized storm systems during the afternoon when solar heating is superimposed upon the man-made heat island. Hydrologically, the 5-year study indicates that the frequency distribution of heavy rainfalls of 5-min to 2-h duration may vary significantly between urban, suburban, and rural areas in large urban-industrial regions, and this variation should be considered in the design and operation of urban hydrological systems. (See also W79-07426) (Bell Graf-Cornell)
W79-07428

STATISTICAL EVIDENCE OF THE INFLUENCE OF URBANIZATION ON PRECIPITATION IN THE RIJNMOND AREA,
Royal Netherlands Meteorological Inst. De Bilt.
G. J. Yperlaan.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 20-30, 1977. 7 fig, 11 ref.

Descriptors: *Precipitation, *Urbanization, *Effects, *Statistical methods, *Areal distribution, Gaging stations, Networks, Pressure, Coasts, Seasonal, Areal clustering, Rotterdam(The Netherlands).

In a statistical study, days with precipitation, as measured at 41 stations, were grouped by season, wind direction and precipitation type. The precipitation amounts within each group were tested for systematic differences and areal clustering. Evidence was found of an increase in precipitation near Rotterdam. (See also W79-07426) (Bell Graf-Cornell)
W79-07429

2C. Snow, Ice, and Frost

THE DEFORMATION OF PACK ICE BY RIDGING,
Bedford Inst. of Oceanography, Datmouth (Nova Scotia).
G. L. Bugden.
Journal of Geophysical Research, Vol. 84, No. C4, p 1793-1796, April 20, 1979. 4 fig, 1 tab, 7 ref.

Descriptors: *Sea ice, *Mechanical properties, *Mathematical models, *Theoretical analysis, Deformation, Analytical techniques, Model studies, Pressure, Compressive strength, Mathematical studies, Ridging.

Some ideas on modeling the deformation of pack ice by ridging were presented. A theory was proposed which, by assuming a constant shape for ridge sections and coupling the ridge frequency to the mean ridge height, provides a thickness redistribution function related to previously developed statistical ridge models. The characteristics of the ridging are parameterized in terms of a single easily measured variable, the mean ridge height. The lower limit of the compressive strength increases linearly with ridge height even when ice of a uniform thickness is engaging in the ridging process. This point may be of some value of modelers of ice movement. (Humphreys-ISWS)
W79-07135

SNOW CRYSTALS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. Perla.
NHRI Paper No. 1, IWD Scientific Series No. 96, 1978, in English and French, 19 p, 10 plates.

Descriptors: *Snow, *Crystals, *Crystallization, Snowpacks, Freezing, Thawing, Sublimation, Winds, Photography, *Banff National Park, *Alberta, Polarized light.

Different types of snow crystals are discussed and illustrated in photographs obtained by passing polarized light through the specimens. The specimens were collected near the Sunshine Ski area of Banff National Park in Alberta. Also discussed are effects of sublimation and wind; re-crystallization in the snowpack; growth of large crystals; crystal layering; and minute life on snow crystals. (WATDOC)
W79-07204

IMPACT FORCE OF SNOW,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. Perla, T. Beck, and J. Banner.
NHRI Paper No. 2, IWD Scientific Series No. 97, 1978, 8 p, 4 fig, 1 ref, 2 tab.

Descriptors: *Snow, *Avalanches, *Density, *Temperature, Model studies, *Alberta, *Banff National Park, Portable storage oscilloscope, Impact pressure.

Cylindrical blocks of snow (mass 20 to 50 kg) were dropped from a height of 10 m onto a circular aluminum plate (thickness 25 mm). Impact forces were measured by load cells and recorded on magnetic tape. For a 50-kg mass, the peak force was 28 kN, occurring about 7 ms after initiation of impact, and decaying to 14 kN in an additional 17 ms. The impact force as a function of time could be represented by an equation which was derived by assuming that the centre of mass of the sample (mass M) decelerates from an impact speed V sub o to rest in a distance d within a force field proportional to sample compression and velocity of compression. The 10-m drop height induced a speed (V sub o equals 13.5 m per s) that was sufficient to flatten and disaggregate the samples. Prediction of F(t) based on assuming d equal to half the sample height is in agreement with measured values. (WATDOC)
W79-07206

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07250

MAPPING OF SEA ICE AND MEASUREMENT OF ITS DRIFT USING AIRCRAFT SYNTHETIC APERTURE RADAR IMAGES,
Technische Hochschule, Graz (Austria).
For primary bibliographic entry see Field 7B.
W79-07327

LEVELS OF AMMONIUM, SULFATE, CHLORIDE, CALCIUM, AND SODIUM IN SNOW AND ICE FROM SOUTHERN GREENLAND,
State Univ. of New York at Buffalo, Amherst. Ice Core Lab.
For primary bibliographic entry see Field 5B.
W79-07329

2E. Streamflow and Runoff

RED CEDAR RIVER BASIN, WISCONSIN: LOW-FLOW CHARACTERISTICS,
Geological Survey, Madison, WI. Water Resources Div.
W. A. Gebert.
Geological Survey Water-Resources Investigations 79-29 (open-file report), March 1979. 12 p, 2 fig, 1 plate, 1 tab, 4 ref.

Descriptors: Low flow, *Streamflow, *Low-flow frequency, *Streamflow forecasting, *Regression analysis, Evaluation, Equations, Base flow, Flow characteristics, Flow duration, Flow rates, Wisconsin, *Red Cedar River basin(Wis).

Low-flow characteristics in the Red Cedar River basin, Wis., where surplus water may be diverted, and methods to determine low-flow characteristics at additional sites are presented. The low-flow characteristics were determined by various methods at 71 sites. For the three gaging stations in the basin, frequency analysis was used to determine the low-flow characteristics. At 17 partial-record sites correlation analyses were used to estimate the low-flow characteristics. Where only a single base-flow measurement was available (41 sites), equations were developed to estimate low-flow characteristics. The relationships were determined from multiple-regression analyses that related low-flow characteristics at gaging stations, low-flow partial-record stations, and sewage-treatment-plant sites to the drainage area and base-flow index values. The standard errors of estimate were determined to be 25 percent for the Q7,2 equation and 34 percent for the Q7,10 equation. For the main stem of the Red Cedar River where only one discharge measurement was available the low-flow characteristics were determined from a drainage area-discharge relationship. Low-flow characteristics were determined at an additional 30 sites in the Red Cedar River basin by various methods. The method used for these sites depended upon the type and amount of data available at each site. (Woodard-USGS)
W79-07013

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE TREMPEALEAU-BLACK RIVER BASIN, WISCONSIN,

Geological Survey, Madison, WI. Water Resources Div.
B. K. Holmstrom.
Geological Survey Water-Resources Investigations 79-9 (open-file report), February 1979. 79 p, 8 fig, 4 plates, 4 tab, 17 ref.

Descriptors: *Low flow, *Streamflow, *Low-flow frequency, *Streamflow forecasting, *Regression analysis, Equations, Base flow, Evaluation, Flow characteristics, Flow duration, Flow rates, Wisconsin, *Trempealeau-Black River basin(Wis).

Low-flow characteristics of streams in the Trempealeau-Black River basin, Wis., include estimates of low-flow frequency and flow duration at 9 gaging stations; low-flow frequency characteristics at 20 low-flow partial-record stations and 41 miscellaneous sites; and a list of base-flow discharge measurements and low-flow characteristics at 117 miscellaneous sites with one or two discharge measurements. Equations are provided to estimate low-flow characteristics at sites without discharge measurements and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the annual minimum 7-day mean flow below which the flow will fall on the average of once in 2 years and once in 10 years. (Woodard-USGS)
W79-07019

FLOOD CHARACTERISTICS OF ALASKAN STREAMS,
Geological Survey, Anchorage, AK. Water Resources Div.
R. D. Lamke.
Geological Survey Water-Resources Investigations 78-129 (open-file report), 1979. 61 p, 21 fig, 6 tab, 5 ref.

Descriptors: *Alaska, *Floods, *Peak discharge, *Flood frequency, *Streamflow forecasting, Regression analysis, Hydrologic data, Climates, Topography, Evaluation.

Peak discharge data for Alaskan streams are summarized and analyzed. Multiple-regression equations relating peak discharge magnitude and frequency to climatic and physical characteristics of 260 gaged basins were determined in order to estimate average recurrence interval of floods at ungaged sites. These equations are for 1.25-, 2-, 5-, 10-, 25-, and 50-year average recurrence intervals. In this report, Alaska was divided into two regions, one having a maritime climate with fall and winter rains and floods, the other having spring and summer floods of a variety or combinations of causes. Average standard errors of the six multiple-regression equations for these two regions were 48 and 74 percent, respectively. Maximum recorded floods at more than 400 sites throughout Alaska are tabulated. Maps showing lines of equal intensity of the principal climatic variables found to be significant (mean annual precipitation and mean minimum January temperature), and location of the 260 sites used in the multiple-regression analyses are included. Little flood data have been collected in western and arctic Alaska, and the predictive equations are therefore less reliable for those areas. (Woodard-USGS)
W79-07027

GRAIN-SIZE DISTRIBUTION OF SUSPENDED LOAD IN RELATION TO BED MATERIALS AND FLOW VELOCITY,
Indian Statistical Inst., Calcutta. Geological Studies Unit.
For primary bibliographic entry see Field 2J.
W79-07050

THE CONVERGENCE OF IMPLICIT BED TRANSIENT MODELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-07107

FLOW RESISTANCE IN GRAVEL-BED RIVERS,
University of East Anglia, Norwich (England). School of Environmental Science.
R. D. Hey.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, p 365-379, Proceedings Paper 14500, April 1979. 5 fig, 4 tab, 28 ref, 1 append.

Descriptors: *Gravels, *Flow resistance, *Beds, *Rivers, Open channel flow, Roughness(Hydraulic), Uniform flow, Shape, Darcy-Weisbach equation, Hydraulics, Equations, Mathematical studies, Friction, Darcy-Weisbach friction factor.

The resistance to uniform flow in straight gravel-bed rivers is basically dependent on the flow geometry, the cross-sectional variation in roughness heights, and the roughness height of the graded gravel bed sediment. The effect of these factors on the resistance to flow was evaluated, and a general approach for the estimation of the Darcy-Weisbach friction factor was presented. Independent field data indicated that the method can be successfully applied to predict the resistance to uniform flow in gravel-bed rivers. (Lee-ISWS)
W79-07108

EMERGENCY WATER SUPPLIES FROM GROUND WATER IN HUMID REGIONS,
Harris (Frederic R.), Inc., NY.
For primary bibliographic entry see Field 2F.
W79-07114

DETERMINISTIC-SYSTEMIC RELATIONSHIPS IN OVERLAND FLOW ANALYSIS,
University of Southern California, Los Angeles. Dept. of Civil Engineering.
S. S. Butler.
Water Resources Bulletin, Vol. 15, No. 2, p 519-529, April 1979. 5 fig, 1 tab, 8 ref.

Descriptors: *Overland flow, *Storm runoff, *Model studies, Mathematical models, Drainage, Rain, Rainfall, Precipitation(Atmospheric), Storms, Precipitation excess, Runoff, Rainfall-runoff relationships, Peak discharge, Surface drainage, Time of concentration, Flow, Hydrology, Hydraulics, Deterministic-systemic relationships.

An analysis of storm runoff was presented, giving primary attention to deterministic-systemic relationships. So that system aspects can be emphasized, other aspects were kept simple; analysis was made for uniform rainfall on a strip of uniform width, limiting direct applicability to small areas. Two relationships between excess rain and time of concentration, one based on hydraulic parameters, the other on hydrologic characteristics, were combined in a solution for peak discharge. The hydraulic expression gives the interrelationship of time of concentration, excess rain, friction, length, and slope. The hydrologic relationships was achieved by converting ordinary intensity-duration curves to corresponding excess rain intensity-duration curves, thereby interrelating excess rain, time of concentration, and loss characteristics. The resulting solution for peak discharge allowed for systemic feedback among both hydraulic and hydrologic parameters. (Sims-ISWS)
W79-07115

INITIATION OF RIPPLE MARKS UNDER OSCILLATING WATER,
Kyushu Univ., Fukuoka (Japan). Research Inst. for Applied Mechanics.
For primary bibliographic entry see Field 2J.
W79-07151

MATHEMATICAL MODELING OF DRAINAGE WATERSHEDS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7C.
W79-07169

REVIEW OF PROBLEMS WITHIN COMBINED AND PARTLY COMBINED SEWERAGE SYSTEMS IN THE PROVINCE OF ONTARIO.
Gore and Storrie Ltd., Toronto (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Training and Technology Transfer Division (Water), EPS, Environment Canada, Ottawa, Canada; Ontario Ministry of the Environment, Pollution Control Br., Toronto, Ont., 160 p, 6 app, 6 fig, 10 tab, 1979.

Descriptors: *Sewerage, *Sewer systems, *Infiltration, *Inflow, *Floods, *Overflow, *Bypasses, Topography, Soil properties, Water reuse, Water pollution treatment, Drainage water, Human population, Cost trends, *Ontario.

The objective of this project was to identify, assemble, screen and assess background information relating to combined and partly combined sewer systems in Ontario. Case histories of six municipalities were used to emphasize problems and solutions. A questionnaire was sent to 245 municipalities and a 77 percent response was received. In addition, 33 reports were received and analyzed. The replies and reports, analyzed in seven categories, did not indicate significant correlation and trend. The most prevalent problems indicated by the municipalities were of a quantitative nature. They included: infiltration and inflow, basement flooding, overflows, overloading, bypassing, and area flooding. The effect on receiving water quality of combined sewer overflows did not appear to be a municipal concern. The geographical distribution, topography, soil conditions and historical background were found to have practically no correlation with combined or partly combined sewer development and their problems. This was also the case with urban population factors, sewer separation programs, economics and other such factors. (WATDOC)
W79-07210

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
P. H. Weiner.
Detroit University Journal of Urban Law, Vol. 54, No. 4, p 743-63, Summer, 1977.

Descriptors: *Water control, *Water management, *Rio grande river, *Water rights, Waterquality control, Water supply, Water resources, Water districts, Political aspects, Texas, Irrigation.

The latest episode in the Lower Rio Grande River Valley's century long struggle over scarse water resources is chronicled. Chief among the districts authorized by Texas Statutes are water control and improvement districts (WCID's) now governed by Chapter 51 of the Texas Water Code. Despite the versatility of WCIDs, they have been used in the Lower Valley almost exclusively for irrigation, and chicano colonias have been excluded from their memberships. The solution was rural water supply corporation. Despite its drawbacks, the Military Highway Supply Corporation (MHSC) was created to obtain water rights for colonias that needed them, to contract with existing facilities, and to construct delivery systems for each colonia. There followed a legal battle to gain power in the districts through the election of directors. It was held that: the state had exclusive power to determine the boundaries of its political subdivisions; that the discrimination by the district was between urban and non-urban property owners and not by race; and that notice by publication was acceptable. Power remains concentrated in the hands of Anglo growers, who have both the will and the ability to wield it. (Fortin-Florida)
W79-07236

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,

For primary bibliographic entry see Field 6E.
W79-07250

UNCERTAINTY IN STEP-BACKWATER ANALYSES,
Dames and Moore, Washington, DC.
A. Motayed, and D. R. Dawdy.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Technical Note, p 617-622, May 1979. 1 tab, 4 ref, 1 append.

Descriptors: *Backwater, *Flow profiles, *Computer models, *Risks, *Oregon, Analytical techniques, Analysis, Gradually varied flow, Rivers, River flow, Floods, Water levels, Model studies, *Umpqua River, Step-backwater analyses.

This study examined the uncertainties introduced due to different techniques in the three most commonly used step-backwater computation programs: HEC-2, developed by the Army Corps of Engineers Hydrologic Engineering Center; E-431, developed by the Geological Survey; and WSP-2, developed by the Soil Conservation Service. In order to anaklyze the mathematical uncertainties in the step-backwater computations by the three programs, a reach, about 4 miles long, of the Umpqua River in Douglas County, Oregon, was chosen as a test area. The Umpqua is a large river with a 100-yr discharge of 294,000 cfs and a flat channel (slope being on the order of 0.0008 ft/ft) and a maximum depth of over 50 ft. The major conclusion was that exact data can result in differences of up to 1.9 ft in 100-yr flood elevation, on the average, depending upon the step-backwater program used. The Umpqua is a large river and obviously this difference is not an absolute measure of uncertainty but is expected to indicate a relative measure. This is an uncertainty of about 4% of maximum depth for this study, but it may vary for other stream channels and other floods. However, this uncertainty cannot be eliminated because there is at present no means to judge among various programs. (Humphreys-ISWS)
W79-07312

CROP RESIDUE EFFECTS ON RUNOFF,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center; and Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
C. A. Onstad, and M. A. Otterby.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 94-96, March-April 1979. 4 fig, 18 ref.

Descriptors: *Runoff, *Southeast US, *Farm management, *Soils, *Infiltration, Soil types, Soil water, Crops, Water conservation, Storage, Permeability, Rainfall, Storms, Agriculture, *Crop residues, *Tillage practices, Residue management.

Crop residues on the soil surface decrease runoff from all storm sizes and eliminate runoff from most small storms. Runoff reductions and consequent increases in storage is greatest in the southeastern U.S. (Sims-ISWS)
W79-07338

GRAND COULEE THIRD POWERPLANT, DEGRADATION STUDY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. O. Blanton, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 531, Price codes: A08 in paper copy, A01 in microfiche. Report, February 1979. 148 p, 77 fig, 21 tab, 5 ref.

Descriptors: *Channels, *Grand Coulee Dam, *Columbia River(Washington), *Channel morphology, *Channel flow, Riprap, Flow rates, Flow characteristics, Peak discharge, River flow, River beds, Hydraulics, Hydrologic data, Bank stability, Equilibrium.

A study of a six mile reach of the Columbia River downstream of Grand Coulee Dam was undertaken to check channel stability and to recommend remedial measures for protection of unstable areas. Because of fill material placed against the right bank, and the change to high-flow peaking operations, the river will attempt to reach a new equilibrium condition. Some changes have already begun to show on the riverbed and on both banks. Rapidly varying flow will be sustained to a magnitude approaching 400,000 cu ft/second due to peaking operations. Existing and future conditions were used as a basis for the analysis of channel stability, with consideration given to the magnitude of planned peaking flows. Recent channel surveys, bed and bank material size distributions, surface and underwater photographs of the riverbed and banks, measured velocity distributions, and observed water surface profiles were among the basic data. Nine specific recommendations for protective measures in the channel are made. (Davison-IPA)
W79-07369

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION I,
CH2M/Hill, Portland, OR.
May 1974. 147 p, 53 fig, 24 ref, 3 append. DACW57-73-C-0155.

Descriptors: *Water resources planning, *Flood damage, *Flooding, *Flood data, *Maximum probable flood, *Flood profiles, *Flood damages, *Methodologies, *Willamette River(OR), Flood discharge, River basins, Oregon, Flood stages, Structural damage, Flood plains, Crest stage gages, Flood measurement, Economic impact, Social impact, Electronic data processing.

This study develops a methodology for determining potential flood damages in the northern portion of the Willamette River System of Oregon. The purpose is twofold; to establish the value of all damageable property and estimate the value of potential damages from hypothetical flood stages of the Portland reach of the Willamette River, and to identify more detailed procedures which might be adapted and used for flood damage modeling in other areas. Potential values and damages are estimated for 8 hypothetical floods, from a 40- to a 5,000-year frequency. Detailed methodologies are presented for determining property values and damages in each flood plain. At the Morrison Street Bridge, the water surface level would be 20 feet mean sea level (msl), 35 ft. msl, and 50 ft. msl for the 40-, 500- and 5,000-year frequency floods, respectively. Property damages include residential, and commercial and industrial property as well as bridges, roads, utilities and public and private facilities. Evaluation of potential structural damages from floods ranges from $53,101,000 (40-year flood) to $712,294,000 (5,000-year flood) for the study reach. Nonprimary flood damages could also occur to environmental/aesthetic resources, historical structures, and to the social well being of the society of the river valley. Conclusions are that the methodology can be applied to other areas, but that some of its elements may need to be modified to be compatible. Appendices include a description of the electronic data processing system used, a quantitative summary, and multicolored flood plain maps. (See also W79-07373) (Arnold-NC)
W79-07372

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION II,
CH2M/Hill, Portland. OR.
May 1974. 424 p, 303 fig, 90 ref, 3 append. DACW 57-73-C-0155.

Descriptors: *Water resources planning, *Flood damage, *Flooding, *Flood data, *Maximum probable flood, *Flood profiles, *Flood damages, *Methodologies, *Willamette River(OR), Flood discharge, River basins, Santiam River(OR), Calapooia River(OR), Flood stages, Structural damages, Flood plains, Crest stage gages, Flood measurement, Economic impact, Social impact, Electronic data processing.

This study develops a methodology for determining potential flood damages in the southern four reaches of the Willamette River System of Oregon: the Willamette River, the Santiam and South Santiam Rivers, and the Calapooia River. The purpose of this project is twofold: to establish the value of all damageable property and estimate the value of potential damages from hypothetical flood stages of these study reaches of the river system, and to identify more detailed procedures which might be adapted and used for flood damage modeling in other areas. Detailed methodologies are presented for determining property values and damages in each of the 4 flood plains. Four hypothetical floods were investigated-100-, 500-, 2,000- and 5,000-year (Maximum Probable Flood-MPF) frequencies. On the Willamette River at the Albany gage the 100-year flood would reach a level of 90.5 ft. mean sea level (msl), while the MPF would crest at 217 ft. msl. The highest stage would be reached on the South Santiam River, with the MPF cresting at 402.4 msl. Property value determinations include residential, commercial and industrial, utilities, moorages and agriculture. Evaluation of total potential flood damage to land, structural improvement, and personal property for the four study ranges from $391,287,000 for the 100-year flood to a high of $1,224,252,000 for the MPF. Nonprimary flood damages could also occur to environmental/aesthetic resources, historical structures, and to the social well being of the society of the river valley system. The report concludes that the methodology can be applied to other areas, but that some of its elements may need to be modified to be compatible. Appendices include a description of the electronic data system used, a quantitative summary, and multicolored flood plain maps. (See also W79-07372) (Arnold-NC)
W79-07373

SPECIAL FLOOD HAZARD INFORMATION REPORT: DEER CREEK, GLENROCK, WYOMING.
Army Engineer District, Omaha, NE.
Prepared for City of Glenrock, Wyoming December 1971. 20 p, 6 plates, 2 tab.

Descriptors: *Wyoming, *Floods, *Regional flood, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Flood peak, *Deer Creek(WY), Runoff, Flooding, Flood frequency, Flood recurrence interval, Flood damage, Rivers, Floodways, Standard project flood, Flood protection, Flood plain zoning, Glenrock(WY), Little Deer Creek(WY), West Fork Deer Creek(WY), Intermediate regional flood.

The Deer Creek Basin is a 213 square mile area in east central Wyoming. The drainage basin is 30 miles long and up to 7 miles wide. Two major tributaries of Deer Creek are West Fork Deer Creek in the central basin and Little Deer Creek in the lower Basin. About a third of the flood plain in the study area is covered with trees, and its main use is for livestock production. Oil wells are located in the flood plain. Some urban development is located in the flood plain around the city of Glenrock. Flood records were obtained from a gaging station in operation since 1924. Floods are caused by heavy spring and summer rainfall, sometimes augmented by snowmelt. The largest flood occurred in June 1970, discharging 14,200 cubic feet per second (cfs). Damages came close to $1,000,000. Another large flood in May 1965 discharged 12,800 cfs. After an occurrence of the Intermediate Regional Flood (IRF), the Deer Creek surface area would swell to more than eight times its normal width and add up to ten feet to its depth. The Standard Project Flood (SPF) would swell the stream an additional 10-15% in area and in depth. The IRF would have an estimated discharge of 12,700 cfs, while the SPF would have an estimated discharge of 31,500 cfs. The study concludes that future development should not be located in the flood plain. Fast peaking of floods at Glenrock presents a hazard. This study is intended to identify flood hazard areas for the benefit of planning officials. (Arnold-NC)
W79-07374

SPECIAL FLOOD HAZARD INFORMATION, SNAKE RIVER, WILSON, WYOMING AND VICINITY.

Army Engineer District, Walla Walla, WA.
Prepared for Teton County, Wyoming, February 1976. 9 p, 15 plates.

Descriptors: *Wyoming, *Floods, *Flood stages, *Wilson(WY), *Snake River(WY), Runoff, Floodwater, Flooding, Historic floods, Peak discharges, Flood peak, Flow duration, Rivers, River beds, Flood plains, Flood protection, Control structures, Levee, Jackson Hole(WY), Moose(WY), 100-year flood, 500-year flood, Gros Ventre River(WY).

This report presents pertinent flood data for a 28.1 mile stretch of the Snake River in northwestern Wyoming. The reach extends from the U.S. Highway 89 bridge at the downstream end of the Jackson Hole Valley to the town of Moose. The average slope of the stream within the study reach is about 19 feet per mile. The Snake River drains an area of 1,878 square miles above the mouth of the Gros Ventre River, and 2,500 square miles at the Wilson Bridge. Maximum flood peak discharges have occurred seven times between 1894 and 1943, ranging from 22,800 cubic feet per second (cfs) to 41,000 cfs at the Wilson Bridge. Peak discharges for the Snake for the 100-year flood would be 23,300 cfs at the Wilson Bridge. For the 500-year flood, the peak discharge would be 45,000 cfs. Flood profiles indicate that the 100-year flood would inundate approximately 30% additional area above that of normal flow stage. Flood damage reduction measures include Jackson Lake, operated mainly for irrigation but providing regulation for the 100-year flood; and the U.S. Army Corps of Engineers' Jackson Hole Project, a series of levees which contain the Snake River from a point 4.2 miles below the Wilson Bridge to 11.2 miles above the bridge which also provides protection for the 100-year flood. There are no city or county regulatory measures aimed specifically at flood damage reduction. Increasing development is expected in the study area. This report does not provide proposals for solution of flood problems. (Arnold-NC)
W79-07375

SPECIAL FLOOD HAZARD INFORMATION: WALNUT CREEK, SPRINGTOWN, TEXAS.
Army Engineer District, Fort Worth, TX.
Prepared for the City of Springtown, Texas August 1974. 22 p, 3 fig, 4 plates, 2 tab.

Descriptors: *Texas, Standard project flood, *Flood protection, *Browders Creek(TX), *Springtown(TX), *Walnut Creek(TX), Floods, Flooding, Historic floods, Flood frequency, Flood stages, Peak discharge, Rivers, Floodways, Flood plains, Flood plain zoning, Building codes, Land use, Zoning, Control structures, Floodproofing, Unnamed Creek(TX), Intermediate regional flood.

This report details flood information for the Walnut Creek watershed near Springtown, Texas, about 27 miles northwest of Fort Worth. A drainage area of 80.6 square miles, the basin experienced serious flooding in 1951, 1959, 1962, and 1973. Information on flooding was obtained from interviews and newspaper records. The July 1973 flood of the Browders Creek tributary raised water depth more than 10 feet above flood stage and did serious, though isolated, structural damage. The estimated maximum peak flow discharge on Walnut Creek below Browders Creek of the Intermediate Regional Flood (IRF) is 18,800 cubic feet per second (cfs), with a maximum increase in water depth of about 11 feet. Though no flood control structures existed in the basin at the time of this report, the U.S. Soil Conservation Service was considering initiating a flood prevention work plan study which could result in the erection of such a structure. Proposed guidelines for floodplain management are presented, including selective zoning with designation of encroachment lines delineating the floodway zone, narrowing the floodway to accomodate controlled economic development in the adjacent floodplain, institution of new subdivision regulations including building code amendments to require stricter construction requirements for new structures, floodproofing existing structures, health regulations to control sewage disposal in the floodway, developing faster and more accurate flood forecasting, and creating development policies which control extension of public services into the flood hazard area. (Arnold-NC)
W79-07378

FLOOD PLAIN INFORMATION: NATRONA COUNTY, WYOMING, NORTH PLATTE RIVER.
Army Engineer District, Omaha, NE.
Prepared for Natrona County, Wyoming, February 1976, 36 p, 18 fig, 26 plates, 4 tab.

Descriptors: *Wyoming, *Floods, *Historic floods, *Natrona County(WY), *North Platte River(WY), *Flooding, Runoff, Regional flood, Floodwater, Annual flood, Indirect flood measurement, Maximum probable flood, Flood profiles, Flood recurrence interval, Flood stages, Peak discharge, Rivers, Flood plains, Ice jams, Standard Project Flood, Flood protection, Intermediate Regional Flood.

The fourth in a series of reports on watersheds of the North Platte River in Wyoming, this study analyzes the flood hazard to that portion of the river in Natrona County of southeast Wyoming. The flood plain is mostly agricultural, with small ranches in the flood plains. Flood season ranges from May through September. Some flooding is caused by winter ice jams. No flood plain regulatory measures are in force in the study area. Data were obtained from U.S. Geological Survey gages, Bureau of Reclamation records, and newspaper files. Floods in excess of 7,000 cubic feet per second (CFS) have been recorded 15 times since 1904; the largest flood of record occurred in May 1929 at the Casper gage, discharging 13,800 CFS; and an ice jam flow occurred in February 1971. The Intermediate Regional Flood (IRF) would cover an area almost 25% larger than that innundated by normal discharge flow, while the Standard Project Flood (SPF) would innundate an area 40-50% wider than normal river width. At the Natrona-Converse County line, the SPF would discharge 14,400 CFS, and the IRF would discharge 43,000 CFS. The five bridges in the study area are potentially obstructive to flood flow and should be modified. The report was prepared for guidance of local officials in planning the use and regulation of the flood plain. (Arnold-NC)
W79-07379

FLOOD HAZARD ANALYSES: NORTH FORK RUSH CREEK, HENNEPIN COUNTY, MINNESOTA,
Soil Conservation Service, St. Paul, MN.
Minnesota Department of Natural Resources and the Elm Creek Management and Protection Commission, MN December 1977. 24 p, 7 fig, 4 append.

Descriptors: *Minnesota, *Floods, *Regional flood, *Rivers, *Flood plains, *Flood protection, *Flood plain zoning, *Building codes, *Zoning, *Hennepin County(MN), *Rush Creek(MN), *Flood plain management, *North Fork Rush Creek(MN), Flooding, Annual flood, Indirect flood measurement, Flood profiles, Flood frequency, Historic floods, Flood damage, Frail lands, Flood plain insurance, Land use, Planning, Control structures, Floodproofing, Elm Creek, 500-year flood, 100-year flood.

This report describes the flood hazard potential of the North Fork Rush Creek of the Elm Creek Basin of southeastern Minnesota. Located just northwest of the Minneapolis-St. Paul (Twin Cities) metropolitan area, the Elm Creek Basin last experienced flooding in April 1965 from snowmelt coupled with rain. Approximately 25.3 square miles in area, the drainage basin consists mainly of agricultural lands. Due to its proximity to the Twin Cities, the basin is experiencing rapid urbanization. Historical flood data are limited; the 1965 flood appears to have been of slightly less intensity than the 100-year flood. There are no gaging stations in the study area. Eleven of the 19 road crossings over the creek in the study area would be overtopped by the 100-year flood. At the mouth of the creek, the 100-year flood would discharge 610 cubic feet per second (cfs), while the 500-year flood would discharge 745 cfs. The area's flood plain management program contains some zoning ordinances, but the report recommends a more comprehensive program. Flood plain management techniques and tools are presented. The report proposes that the basin be divided into three zones; secondary flood area, where construction of buildings with basements above flood protection elevation is allowed; flood fringe area, where no basements would be constructed; and floodway, where none except possibly recreational uses would be allowed. (Arnold-NC)
W79-07381

CATCH BASIN INTERCEPTOR,
Calspan Corp., Buffalo, NY. (Assignee).
R. J. Pilie, and D. B. Dahm.
U.S. Patent No. 4,136,010, 9 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1384-1385, January 23, 1979.

Descriptors: *Patents, *Runoff, *Storm runoff, *Pollution abatement, Water storage, Interception, Surface waters, Storm drains, Industrial wastes, Catch basins.

Surface drainage into catch basins frequently contains contaminants which are harmful to the environment and it is desirable that they be intercepted and discharged into holding or treatment facilities. For example, water entering storm drains at major airports may include: spills of oil and fuel; flow of deicing solutions; and the flow of storm runoff which dislodges industrial pollutants from ramp areas and carries them into catch basins. A catch basin may be retrofit for isolating/diverting spills and/or initial storm runoff for the subsequent treatment or recycling of the collected material. A sloping, peripheral trough is provided in the catch basin and is connected to one or more storage or recovery tanks or the like. Several catch basins may be provided with troughs connected to one or more common storage or recovery tanks. (Sinha-OEIS)
W79-07401

URBAN INFLUENCES ON THE WATER BALANCE OF AN ENVIRONMENT,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
V. V. Kuprianov.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 41-47, 1977. 2 tab, 8 ref.

Descriptors: *Urbanization, *Effects, *River basins, *Runoff, *Annual, *Flow, *Large regions, Low flow, Streamflow, Water balance, Estimating, Hydrologic cycle, Towns.

Peculiarities of the formation of the elements of the hydrological cycle in towns are discussed. The possible quantitative changes in the hydrological elements and a town's influence upon the runoff of large river basins and regions are estimated. Specific hydrological features of urban areas are outlined. (See also W79-07426) (Bell Graf-Cornell)
W79-07431

RESEARCH IN WEST AFRICA ON THE EFFECTS OF URBANIZATION ON SURFACE FLOW, (RECHERCHES EN AFRIQUE OCCIDENTALE SUR LES EFFETS DE L'URBANISATION SUR LE RUISSELLEMENT SUPERFICIEL),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Hydrology Section.
J. A. Rodier.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 79-82, 1977. 1 tab, 5 ref.

Descriptors: *Urbanization, *Effects, *Surface waters, *West Africa, *Flow, Basins, Discharge(Water), Equations, Hydrographs, Floods, Runoff coefficient, 'Rational method', Intensity-duration curves.

This paper briefly presents: (1) the results of research carried out on urban basins in Brazzaville (Congo) in 1954; (2) the systematic study of urban basins in Niamey (Niger) in 1963; (3) the experimental results obtained; (4) the attempts to adapt the French Caquot formula for the computation of maximum discharge for the 10-year flood by changing different factors (adjustment for the Ivory Coast and the Sahelo-Sudanese zone; (5) the attempt to use another formula starting from the 'rational method'; and (6) the research program lead by CIEH (Interafrican Committee on Hydraulic Research) and ORSTOM in West Africa for improving knowledge about the runoff coefficients, the shapes of hydrographs and the shapes of intensity-duration curves for very short periods of time, and the general results of this new program. (See also W79-07426) (Bell Graf-Cornell)
W79-07437

FLOOD WAVES FROM IMPERVIOUS AREAS,
Adviesbureau, Arnhem (Netherlands).
J. Bouwknegt.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 93-100, 1977. 9 fig.

Descriptors: *Precipitation, *Flood waves, *Impervious areas, *Nonstationary flows, *St. Venant equations, *Method of characteristics, Networks, Drainage, Discharge(Water), Construction, Open channels, Outfalls, Reach junctions, Cultivation area, Greenhouses, Urban area, Open watercourses, Iteration.

Precipitation falling on an impervious surface generally runs off very rapidly. This results in discharges to the drainage system of considerable intensity and short duration. These essentially nonstationary flows can be described using the St. Venant equations. There are several techniques for solving these equations; used herein is the method of characteristics. Shown is how intricate networks of open watercourses and inherent construction works are calculated by way of iteration. The method, successfully applied to many problems, is described in two of such applications herein. The first relates to a green house cultivation area; the precipitation falling onto the greenhouses is fed into a network of open watercourses as side-flow. The second example deals with the nonstationary discharge through a system of channels in an urban area. The precipitation falling on the urban area is fed into the network through a large number of outfalls as local inflow. (See also W79-07426) (Bell Graf-Cornell)
W79-07439

THE EFFECT OF URBANIZATION ON STORM RUNOFF FROM TWO CATCHMENT AREAS IN NORTH LONDON,
Halcrow (William) and Partners, London (England).
M. J. Hall.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 144-152, 1977. 3 fig, 1 tab, 13 ref.

Descriptors: *Effects, *Urbanization, *Storm runoff, *Hydrologic data, *Catchment areas, *London(Eng), Gaging stations, Rainfall, River flow, Unit hydrographs, Drainage basins, Equations, Baseflow separation, Rainfall loss.

The development of urban areas within a drainage basin may have a marked effect upon its hydrological regime. Owing to the scarcity of hydrometric records from catchments undergoing urban development, the changes in flow regime which occur are often difficult to quantify. One possible approach to overcoming this problem involves: (1) the derivation of unit hydrographs from storms recorded on several catchment areas at different stages of urbanization; and (2) the correlation of variables describing the shape of the unit hydrograph with catchment characteristics, which include descriptions of the urban area and its growth. A study of rainfall and river flow records from two adjacent catchment areas located in the northern suburbs of London has shown that simple measures of urban development, such as the proportion of impervious area, are insufficient to describe the variations in catchment response between ostensibly similar drainage areas. Greater attention should be given to both channel conditions and their modification, and the distribution of urban area within the catchment. (See also W79-07426) (Bell Graf-Cornell)
W79-07443

RUNOFF CONTROL ON URBANIZING CATCHMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2A.
W79-07444

COMPUTER CONTROLLED MEASUREMENTS OF COMBINED WASTE WATER FLOW AND OVERFLOW,
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Wasserguetewirtschaft und Gesundheitsingesieurwesen.
G. Marr, and L. Pieper.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 277-282, 1977. 3 fig, 1 tab.

Descriptors: *Computers, *Control, *Combined sewers, *Storm water, *Overflow, Urban runoff, Waste water(Pollution), Flow, Rain gages, Hydrologic data, Projects, Water quality, Water quantity, Sampling, Munich(W Germany), Measurement.

Storm water runoff and overflow of combined sewer systems from urban areas cause an increasingly important pollution problem. For more detailed knowledge of the relationship between water quality and quantity three raingages were installed in the study area and measuring and sampling devices were installed in an overflow area. The study area is located in Munich and has a size of 542 ha. Data from eight continually measured parameters and from the analyzed sewer samples have been collected and the system controlled by a mini-computer. A survey is presented of the average and the diurnal variations of the data collected so far. (See also W79-07426) (Bell Graf-Cornell)
W79-07455

2F. Groundwater

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE COLORADO SPRINGS--CASTLE ROCK AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
E. C. Hutchinson, and D. E. Hillier.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. microfiche $4.00, paper copy $10.00. Geological Survey open-file report 78-948, December 1978. 41 p, 2 fig, 1 plate, 4 tab, 3 ref.

Descriptors: *Water table aquifers, *Well data, *Water levels, *Water quality, *Hydrogeology, Hydrologic data, Springs, Aquifers, Chemical analysis, Colorado, *Douglas County, *El Paso County.

As part of the U.S. Geological Survey's investigations of the hydrology and geology in the Front Range Urban Corridor of Colorado, hydrologic data for water-table aquifers in the Colorado Springs--Castle Rock area were collected and compiled during 1976-77. These data, consisting of records for 157 wells and 47 springs and chemical analyses of water for 135 of the wells and all 47 springs, are presented in tabular form. The tables contain data that were collected during the investigation, data compiled from reports published by the Colorado Water Conservation Board, and unpublished data from the files of the U.S. Geological Survey. State and local officials in the Colorado Springs--Castle Rock area may find these data useful in planning for residential, commercials, and industrial development. (Woodard-USGS)
W79-07011

THE TUSCALOOSA AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07020

ALLUVIAL HYDROGEOLOGY OF THE LOWER MISSOURI RIVER VALLEY,
Missouri Univ.-Columbia. Dept. of Geology.
N. G. Grannemann, and J. M. Sharp, Jr.
Journal of Hydrology, Vol. 40, No. 1/2, p 85-99, January 1979. 11 fig, 15 ref. OWRT A-085-MO(4).

Descriptors: *Alluvial aquifers, *Groundwater, Missouri River, *Alluvial channels, Flood plains, Aquifers, Groundwater movement, Water levels, Hydrographs, Model studies, Mathematical models, Clays, Sands, Gravels.

Floodplain deposits in the lower Missouri River valley alluvium can be divided horizontally into a channel belt, meander, belt and flood basin; and vertically, floodplain deposits consist of a top stratum and a substratum. The Missouri, like most major rivers in the midwestern U.S., is an underfit stream which does not fully penetrate its alluvium. Large amounts of groundwater are stored in these alluvial deposits, in which both sediment mean grain size and hydraulic conductivity increase exponentially with depth. Digital computer models indicate, however, that only one flow system exists in the alluvium. Digital simulations and field observations of the floodplain near Glasgow, Missouri, showed 4 types of groundwater response to river stage changes: areas of rapidly fluctuating groundwater levels, areas of slow response, areas of predominantly down-valley flow, and areas of continuing groundwater high. The bank storage-river interaction can be mainly effluent, mainly influent, or a combination of both. The most important factor controlling the floodplain groundwater system is river stage variation. Distance from the river, the time interval since the river has fallen or risen, and the geometry of the river and valley walls all affect the groundwater system. In addition, floodplain inhomogeneities, tributary creeks, and pumping may cause perturbations in groundwater levels. (Sims-ISWS)
W79-07104

VERTICAL AND HORIZONTAL LAND DEFORMATION IN A DESATURATING POROUS MEDIUM,
Princeton Univ., NJ. Dept. of Civil Engineering.
N. M. Safai, and G. F. Pinder.
Advances in Water Resources, Vol. 2, No. 1, p 19-25, March 1979. 12 fig, 2 tab, 9 ref.

Descriptors: *Consolidation, *Soil compaction, *Mathematical models, *Water table aquifers, *Dewatering, Soil water movement, Flow, Equations, Saturated flow, Unsaturated flow, Finite element analysis, Immiscibility, Stress, Pressure head, Model studies, Displacement, Three-dimensional field.

Soil deformation due to the flow of two immiscible fluids can be described by a general three-dimensional deformation field coupled with a three-dimensional hydrologic flow field. The resulting system of equations provides the components of displacement, the pressure, and the fluid satura-

tions. The equations governing saturated-unsaturated soil deformation are obtained as a simplified subset of a more general multiphase formulation. These equations can be solved numerically using an iterative Galerkin finite element technique with a weighted implicit finite difference approximation of the time derivative. A mixed stress-displacement formulation of the governing equations provides the flexibility necessary to consider both stress and displacement boundary conditions. The model predicts the commonly ignored horizontal displacements in a variably saturated system undergoing simultaneous desaturation and deformation. This is accomplished using completely coupled stress and pressure fields. The model provides vertical and horizontal displacement and changes in pressure (head) and saturation as a result of fluid withdrawal in a phreatic aquifer. (Visocky-ISWS)
W79-07112

UNSTEADY-STATE, TWO-DIMENSIONAL RESPONSE OF LEAKY AQUIFERS TO STREAM STAGE FLUCTUATIONS,
Gannett, Fleming, Corddry, and Carpenter, Inc., Harrisburg, PA.
R. J. Dever, Jr., and R. W. Cleary.
Advances in Water Resources, Vol. 2, No. 1, p 13-18, March 1979. 6 fig, 12 ref.

Descriptors: *Surface-groundwater relationships, *Aquifers, *Streamflow, *Leakage, *Mathematical models, Equations, Unsteady flow, Bank storage, Water levels, Hydrographs, Hydraulic conductivity, Aquitards, Stream stage, Leaky artesian aquifers.

The response of stream-leaky aquifer systems with semipermeable stream banks to changes in stream stage was considered. Two-dimensional, unsteady analytical solutions for semi-infinite aquifers were derived by integral transform techniques. Solutions for piezometric head, flow into the aquifer, and bank storage were derived for a step function hydrograph. General solutions for head due to an arbitrary hydrograph also were presented for cases both with and without the semipermeable stream bank. The importance of including the effect of the stream bank was demonstrated. (Visocky-ISWS)
W79-07113

EMERGENCY WATER SUPPLIES FROM GROUND WATER IN HUMID REGIONS,
Harris (Frederic R.), Inc., NY.
S. Bagchi, and A. S. Goodman.
Water Resources Bulletin, Vol. 15, No. 2, p 536-549, April 1979. 6 fig, 8 ref.

Descriptors: *Groundwater, *Streamflow, *Low-flow augmentation, *Model studies, Mathematical models, Water supply, Pumping, Recharge, Natural recharge, Artificial recharge, Streams, Low flow, Water demand, Evapotranspiration, Droughts, Water resources.

This paper focused on the development and testing of a mathematical model of an emergency groundwater supply operated principally during periods of low streamflow. The process of groundwater withdrawal and recharge was simulated taking account of streamflow, water demand, evapotranspiration, natural and artificial recharge, and increased evapotranspiration due to artificial recharge, groundwater pumpage, and streamflow contribution to pumped water. The model determined whether natural recharge is possible in less time than the return period of drought and also whether artificial recharge is needed. By simulating operation over a long period of time, the model can examine different droughts of short and long duration and can test the operating rules for groundwater storage development in an area. Submodels analyze the components of the operating process, including groundwater flow into the stream, seepage losses, stream portion of well discharge due to induced infiltration, and recharge from rainfall or water spreading. The model has been tested for areas in the humid northeastern United States. (Sims-ISWS)
W79-07114

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
F. H. Dove, and P. J. Schreuder.
Water Resources Bulletin, Vol. 15, No. 2, p 326-336, April 1979. 4 fig, 11 ref.

Descriptors: *Hydrology, *Regional analysis, *Water wells, *Municipal water, *Florida, Water levels, Water quality, Groundwater, Wells, Sites, Saline water-freshwater interface, Saline water intrusion, Water resources, Water management(Applied), Aquifers, Water yield, Costs, On-site investigations, Regional economics, Planning, Water resources, Site-selection criteria, Criteria weighting.

A visual selection technique can be utilized to locate potential well field sites prior to on-site testing. The technique is based upon an understanding of the regional hydrology and an appreciation for such development goals as the identification of high-yield and low-impact locations. Although the uniqueness of Pasco, Pinellas, and Hillsborough Counties in Western Florida has been incorporated into the current application, the methodology, with modifications, is transferable to other geographic regions. Overlays of each criterion used in site selection were combined to form a regional composite showing favorable site locations and to serve a useful communications role as visual aids during public presentation. Implications of direct and indirect cost savings to the public are obtained when the methodology is applied to the location of municipal well fields. (Sims-ISWS)
W79-07116

HYDRAULIC CHARACTERISTICS OF THE WHITE RIVER STREAM BED AND GLACIAL OUTWASH DEPOSITS AT A SITE NEAR INDIANAPOLIS, INDIANA,
Indiana Dept. of Natural Resources, Indianapolis.
For primary bibliographic entry see Field 8B.
W79-07198

WETLAND PROTECTION IN COMPLIANCE WITH NEPA,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07238

GROUNDWATER POLLUTION IN SOUTH DAKOTA: A SURVEY OF FEDERAL AND STATE LAW,
For primary bibliographic entry see Field 6E.
W79-07247

ELECTRIC ANALOG MODEL STUDY OF AQUIFER IN KRISHNI-HINDON INTERSTREAM REGION, U.P., INDIA,
National Geophysical Research Inst., Hyderabad (India).
C. P. Gupta, M. Thangarajan, and V. V. S. Gurunadha Rao.
Ground Water, Vol. 17, No. 3, p 284-290, May-June 1979. 8 fig, 1 tab, 5 ref.

Descriptors: *Groundwater, *Water resources, *Aquifers, *Model studies, Analog models, Pumping, Drawdown, Water levels, Transmissivity, Hydraulic conductivity, Groundwater recharge, Rivers, Rainfall, Irrigation, Evapotranspiration, Hydrology, Hydrogeology, *India, *Uttar Pradesh(India).

Overexploitation of groundwater in Krishni-Hindon interstream region (Lat. 29 deg 05 min N - 29 deg 29 min N and Long. 77 deg 19 min E - 77 deg 32 min E) in Uttar Pradesh, India, prompted us to carry out aquifer modeling studies. The area lies in Gangetic alluvial plain. The interconnection in the phreatic aquifer and the lower semiconfined aquifer led to the assumption of a single-story aquifer for which an R-C analog model was constructed. The input-output quantities in the model were simulated using current/voltage generators and current sinks which were programmed appropriately in time-domain with the help of waveform synthesizers for a realistic representation of the field system. The model study showed that the aquifer can sustain the present output rate of 200 mcm/year without much damage to the groundwater regime. In another scheme, an annual increase of 5% in exploitation rate showed deleterious effects on the aquifer. Decreased rainfall/droughts would worsen the situation. The influence of hydraulic connectivity between the aquifer and the Krishni-Hindon river system is quite significant. If the present exploitation rate were to continue for 20 years, the annual inflow to the aquifer from rivers was estimated to increase by about 36 mcm. More hydrogeological data is required for further validation and refinement of the model. (Sims-ISWS)
W79-07323

REVIEW OF LEAKY ARTESIAN AQUIFER TEST EVALUATION METHODS,
Upper Mississippi River Basin Commission, Twin Cities, MN.
W. C. Walton.
Ground Water, Vol. 17, No. 3, p 270-283, May-June 1979. 11 fig, 11 tab, 15 ref.

Descriptors: *Groundwater, *Artesian aquifers, *Analytical techniques, *Evaluation, Leakage, Groundwater movement, Aquifers, Aquitards, Wells, Water wells, Drawdown, Pumping, Regression analysis, Model studies, Mathematical models, Storage, Hydrology, Hydrogeology, Leaky artesian aquifers.

Flow to wells in leaky artesian aquifers is intimately related to changes in aquitard storage, well storage capacity, and degree of well penetration. The manner and extent to which these and other factors affect water levels may be evaluated with aquifer test data. Families of type curves describe time-drawdown in the aquifer and aquitard under complex aquifer and well-penetration conditions. Analysis of leaky artesian aquifer test data is possible with the array of equations derived largely in the 1950's through 1970's. Erroneous data analysis will result unless complicating factors are fully recognized and taken into account. A review of leaky artesian aquifer test evaluation methods was presented in this paper together with the field application of selected methods to foster greater use of current theories. (Sims-ISWS)
W79-07324

LOCATING GROUND WATER IN THE SANTA CATHERINA AREA USING GEOPHYSICAL METHODS,
Geological Survey of Israel, Jerusalem. Hydrogeology Div.
D. Wachs, A. Arad, and A. Olshina.
Ground Water, Vol. 17, No. 3, p 258-263, May-June 1979. 7 fig, 3 ref.

Descriptors: *Groundwater, *Water resources, *Surveys, Geology, Geomorphology, Aquifers, Locating, Water supply, Rocks, Alluvium, Wells, Water wells, Hydrogeology, *Israel, *Sinai(Israel), *Santa Catherina(Israel), Geophysical techniques.

An attempt was made to locate groundwater in an arid, mountainous area in the Santa Catherina region of southern Sinai. A combination of classical geological methods, together with geophysical techniques, was found to be particularly useful for the locality studied. It was found that water flow was mainly through the joints of the crystalline basement and that under favorable circumstances, fair groundwater supplies can be found in alluvial valley fill. It was concluded that recharge of valley fill is derived mainly from the joint system of the bedrock and only partially from flooding. (Sims-ISWS)
W79-07325

MAINE'S GROUND-WATER SITUATION,
Maine Geological Survey, Augusta.
W. B. Caswell.
Ground Water, Vol. 17, No. 3, p 235-243, May-June 1979. 17 fig.

Descriptors: *Groundwater, *Aquifers, *Geology, *Maine, Alluvial aquifers, Artesian aquifers, Sand aquifers, Water levels, Bedrock, Water wells, Water resources, Water quality, Faults(Geologic), Fractures(Geologic), Coasts, Saline water intrusion, Groundwater movement, Recharge, Natural recharge, Groundwater recharge, Hydrogeology.

Maine's population is highly dependent upon groundwater supplies that are obtained from low-yield, fractured, crystalline bedrock aquifers. Although most domestic bedrock wells yield less than 10 gallons per minute (gpm), there are a number of bedrock wells that yield 10 to 300 gpm. Many of these wells are drilled in the vicinity of major faults. Some bedrock wells intersect fractures that open directly to the land surface, which causes them to be particularly susceptible to contamination. The glacial cover is generally less than 20 feet thick and is not considered a significant aquifer in most places. Sand and gravel aquifers are scattered across the state, but in total cover only about 15% of the surface. Coastal residents commonly obtain water from the fractured rock aquifer. Saltwater intrusion occurs, but in most places appears to be caused by the geometry of the rock fractures rather than by excessive pumping. Groundwater quality is generally good because of low solubility of the crystalline rocks and because of dilution by plentiful rainfall. (Sims-ISWS)
W79-07326

GROUNDWATER RECHARGE IN THE DOLOMITE OF THE GHAAP PLATEAU NEAR KURUMAN IN THE NORTHERN CAPE, REPUBLIC OF SOUTH AFRICA,
Geological Survey of South Africa, Pretoria. Dept. of Mines.
P. J. Smit.
Water S. A., Vol. 4, No. 2, p 81-92, April 1978. 13 fig, 3 ref.

Descriptors: *Groundwater recharge, *Natural recharge, *Springs, *Subsurface waters, *Hydrology, Geologic units, Geohydrologic units, Flow measurement, Evapotranspiration, Rainfall, Ghaap Plateau(South Africa), Water levels, Leakage, Surface runoff, Boreholes, Evaporation.

The flows of several natural springs on the dolomite of the Ghaap Plateau Formation were measured between 1959 and 1970 to determine natural groundwater recharge. The underground catchment, or groundwater compartment, delineated from a survey of the water levels, has a surface area of about 1,140 sq km; groundwater from this area is drained by four springs. In some of the 50 smaller subcompartments springs drain the underground water into the adjoining compartment. A groundwater balance sheet was drawn up with all possible groundwater losses taken into account prior to measuring the flow at the point of discharge at the springs. Although the general groundwater in the area is rarely less than 20 m below the surface, it ranged between ground level and 200m below the surface. The average annual recharge during the study period was calculated to be 2.5% of the 346 mm annual rainfall. Groundwater recharge, based on the potential evapotranspiration rate and calculated according to the Thornthwaite Method, was 2.94% for the 1940 to 1970 period with an average rainfall of 445 mm. (Davison-IPA)
W79-07363

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 5. GENERAL GEOLOGY AND SEISMICITY,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
E. A. Dardeau, Jr., and M. A. Zappi.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 828, Price codes: A04 in paper copy, A01 in microfiche. Technical Report M-77-4. September 1977, 62 p, 2 tab, 12 fig, 29 ref. 4A162121A8696.

Descriptors: *Geology, *Natural resources, *Geologic investigations, *Geologic time, *Hydrology, *Geologic units, *Groundwater resources, *Fort Carson(CO), *Military installations, Aquifers, Water supply, Seismology, Hydrography, Surface hydrology, Holocene, Environmental data, Environmental management, Stratigraphy.

This report is the fifth in a series of six reports describing methodologies and procedures to collect environmental baseline data that are pertinent to the Fort Carson Long-Range Environmental Program. This report covers the general geology and seismicity of Fort Carson and shows how geologic and seismic parameters relate to engineering and resort management practices of this military installation. The project accomplishes four main tasks: (1) outlines the effect of physiography on climate, surface hydrology, and sedimentation; (2) describes geologic structure and stratigraphic units and discusses the engineering importance of these units; (3) locates water wells and discusses water-bearing strata (aquifers) in the Fort Carson area; (4) correlates seismicity with engineering and resource management problems. Fort Carson lies in both the Great Plains and Southern Rocky Mountain physiographic provinces. Geologic structural features on Fort Carson can be a source of potential seismic activity, can present problems in construction, and can cause difficulties in locating groundwater. The supplies of groundwater at Fort Carson are inadequate both in terms of quality and quantity. The area has been free of serious earthquakes, but hazards to construction exist even from minor quakes. The report recommends the establishment of several permanent meteorologic stations and a stream gaging and sediment sample collection program at Fort Carson. (Coan-NC)
W79-07386

EFFECTS OF URBANIZATION ON GROUNDWATER, (EFFETS DE L'URBANISATION SUR LES EAUX SOUTERRAINES),
Bureau de Recherches Geologiques et Minieres, Orleans, (France). Dept. Carte Geologique et Geologie Generale.
L. Monition.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 162-166, 1977. 9 ref.

Descriptors: *Urbanization, *Groundwater, *Effects, *Simulation analysis, Evaluation, Hydrologic cycle, Water resources, Mathematical models, Systems analysis.

In France, the new law promulated in June 1976 concerning the protection of the natural environment states that the groundwater and the subsoil are resources that must be protected from all forms of degradation. The effects of urbanization on groundwater are characterized by changes in recharge, runoff, piezometric level, flow and physical and chemical properties. The quantitative evaluation of these impacts is now possible by means of simulation techniques which allow one to analyze and predict the detrimental changes. Some examples of the effects of urbanization on groundwater (aquifers) are mentioned: galleries, tunnels, metros, underground parking, canalization of water courses, water supply, and gravel pits. (See also W79-07426) (Bell Graf-Cornell)
W79-07445

THE LYON-SATOLAS AIRPORT. A HYDRODYNAMIC STUDY OF THE MEYZIEUX GLACIER STREAM VALLEY WITH A VIEW TO PROTECTING THE QUALITY OF THE WATER RESOURCES. SIMULATION OF THE TRANSPORT OF POLLUTANTS, (IN FRENCH),
Buereau de Recherches Geologiques et Minieres, Orleans (France). Dept. Carte Geologique et Geologie Generale.
D. Rousselot.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 389-407, 1977. 16 fig, 11 ref.

Descriptors: *Groundwater development, *Water quality control, *Hydrodynamics, *Simulation analysis, *Water supply, Drainage, Mathematical models, Systems analysis, Airports, Measurement, Basins, Structures.

The creation of the Lyon-Satolas airport has raised a number of hydrodynamic problems, reflecting all those which can arise from the siting of any new substructure. The particular problem posed by the airport site is the absence of a nearby river system, purifying system, or water distribution networks onto which it is economically possible to be connected. The solutions to these problems must be sought locally by turning to the groundwater resources, with the view to safeguarding them as far as possible with respect to quality and quantity. Among the problems raised is the water supply of the airport which requires 600 m3/h of water for drinking water and air conditioning, the infiltration of rainwater collected in the airport's wells, the construction of an infiltration of rainwater collected in the airport's wells, the construction of an infiltration basin, the testing and protection of the quality of the aquifer linked to effluents even in this basin, and to the testing and protection of the airport with the risks of accidental discharge of soluble pollutants which can run into it, and the outflow of air conditioning water. A deep hydrodynamic study, with numerous measurements of the transfer characteristics and the positioning of a dispersive model to simulate drainage, has given us the ability to answer to the questions formulated. (See also W79-07426) (Bell Graf-Cornell)
W79-07470

2G. Water In Soils

MONITORING WATER MOVEMENT THROUGH STRIP MINE SPOIL PROFILES,
Science and Education Administration, University Park, PA. Northeast Watershed Research Center.
A. S. Rogowski, and E. L. Jacoby, Jr.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 104-109, 114, January-February 1979. 4 fig, 5 tab, 14 ref.

Descriptors: *Soil water movement, *Spoil banks, *Strip mine wastes, Mine wastes, Infiltration, Erosion, Sediments, Moisture content, Soil water, Lysimeters, Soils, Density, Hydraulic conductivity, Topsoil, Instrumentation, Tensiometers, Soil science.

Two, 3.6-m deep, 2.4-m diameter caissons were used to measure movement in reconstructed spoil profiles. Details were presented of instrumentation and methods were proposed for determining spoil-water-retentivity curves and hydraulic conductivity as a function of water content and/or tensiometer pressure, including a correction for the coarse fragment content. This correction may be significant when modeling flows in the coarse fragment content. This correction may be significant when modeling flows in spoil materials. During water application, it was found that on spoil alone, water infiltrated faster, and less of it was retained in the profile after drainage than on top-soiled spoil. More sediment moved with infiltrating water in the topsoiled profile, and oxygen concentrations after application of water were lower than on spoil alone. Similar situations may prevail in the field. During the initial wetting, settlement was considerable and changes in temperature and bulk density were good indicators of water movement within the spoil and topsoiled spoil profiles. However, flow through larger channels did contribute significant amounts of water to the water table in the spoil without being detected by radioactive probes, temperature probes, or tensiometers. (Sims-ISWS)
W79-07110

STEADY STATE MOISTURE FLOWS IN UNSATURATED SOIL CONTAINING A PLANE, ISOLATED, IMPERMEABLE BARRIER,
Princeton Univ., NJ. Dept. Civil Engineering.
D. K. Babu.
Advances in Water Resources, Vol. 2, No. 1, p 35-45, March 1979. 5 fig, 12 ref, 3 append. NSF ENG77-24979.

Descriptors: *Soil water movement, *Soil water, *Unsaturated flow, *Model studies, Mathematical models, Steady flow, Hydraulic conductivity, Impervious soils, Barriers, Soils, Soil moisture, Equations, Analytical techniques, Hydrology, *Impermeable barriers.

A three-dimensional, axially symmetrical, steady-state flow of moisture in an unsaturated soil was analyzed. The steady-state infiltration was maintained by a constant flux across a circular disc on the horizontal soil surface. The flow encountered an obstacle in the form of a plane circular impermeable barrier of arbitrary radius. Except for this isolated barrier, at a given arbitrary depth, the rest of the soil was homogeneous and isotropic. The governing differential equation was linearized by assuming the hydraulic conductivity to be an exponential function of the pressure head. Techniques associated with dual integral equations constitute the basic tools that were employed in solving this problem. Explicit formulas and expressions were obtained for computing the solution for arbitrary values of the radius of the source, of the radius of the obstacle, and of the distance between them. Keeping the radius of the source as unity, the barrier radius and depth were varied in illustrative examples. Results were plotted in a series of figures. The concluding section briefly mentioned relevance of such analysis to interpretation of field data on moisture contents or calculations of hydraulic conductivity. The problem of flow around an isolated disc in infinite space, with a uniform gravitational flow at large distances from this disc, can also be solved by the methods developed here. This was done, and the results were plotted in a figure. (Sims-ISWS)
W79-07122

PREDICTION OF FIELD SOIL WATER CONTENT,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
D. R. Cameron.
Soil Science Society of America Journal, Vol. 43, No. 2, p 390-394, March-April 1979. 4 fig, 3 tab, 20 ref.

Descriptors: *Soil water, *Soil water movement, *Soil moisture, *Model studies, Mathematical models, Simulation analysis, Hydraulic conductivity, Soils, Precipitation(Atmospheric), Rainfall, Percolation, Percolating water, Air temperature, Evaporation, Soil science.

A 3-year experiment was conducted to monitor and subsequently to predict field water contents using the water transport model. Saturated hydraulic conductivities and soil water characteristic curve results were measured and averaged for each soil layer. The Millington-Quirk (MQ) method was used to calculate average model parameters. Direct use of the MQ-derived conductivity and diffusivity functions did not give an exact fit to the observed field results. However, when reasonable adjustments were made to the K(theta) and D(theta) functions, the prediction was improved considerably. The methodology for 'averaging' and utilizing field data to derive model parameters and subsequent adjustment or optimization of the model parameters all require more research in order to use the unsaturated flow equation for field water content prediction. (Sims-ISWS)
W79-07141

NITRATE LEACHING IN A SLUDGE-TREATED FOREST SOIL,
Science and Education Administration, Morgantown, WV.
R. C. Sidle, and L. T. Kardos.
Soil Science Society of America Journal, Vol. 43, No. 2, p 278-282, March-April 1979. 2 fig, 3 tab, 16 ref.

Descriptors: *Nitrates, *Leaching, *Sludge treatment, *Forest soils, *Model studies, Mathematical models, Solutes, Hardwood, Sludge, Pores, Porosity, Nitrogen, Nitrogen compounds, Nutrients, Forests, On-site investigations, Soil water movement, Soil science.

Anaerobically digested liquid sludge was applied during 2 separate periods to plots in a mixed hardwood forest. High treatment plots received 26.96 metric tons/ha total solids and 3,034 kg/ha N loadings during the two applications, and low treatment plots received approximately half these loadings. Percolate samples collected at the 15-cm depth contained a maximum of 290 mg/liter NO3(-)-N in the high treatment and 194 mg/liter NO3(-)-N in the low treatment. Maximum monthly levels of NO3(-)-N in percolate sampled at the 120-cm depth lagged 6 months behind peak levels at the 15-cm depth. Calculated average active transmitting soil porosity (P sub act), based on field water budget data over this 6-month period, ranged from 15 to 22%. A CSMP computer simulation model based on a solution to the convection diffusion equation estimated the average P sub act to be 15%. Since these data indicate that 27 to 50% of the pores may be stagnant, this suggests that soluble NO3(-)-N was being channeled through interconnected macropores in the soil profile. (Sims-ISWS)
W79-07142

USE OF GOODNESS-OF-FIT TESTS FOR CHARACTERIZING THE SPATIAL VARIABILITY OF SOIL PROPERTIES,
Florida Univ., Gainesville. Dept. of Statistics.
P. V. Rao, P. S. C. Rao, J. M. Davidson, and L. C. Hammond.
Soil Science Society of America Journal, Vol. 43, No. 2, p 274-278, March-April 1979. 3 fig, 2 tab, 17 ref.

Descriptors: *Soil properties, *Variability, *Statistical methods, *Estimating, Analytical techniques, Spatial distribution, Sampling, Soil density, Soil water, Correlation analysis, Statistical models, Monte Carlo method, Hydraulic conductivity, Equations, Dispersion, Log normal distribution.

Application of the empirical distribution function statistics to describe the spatial variability of soil properties was discussed. The Kolmogorov statistic and the Cramer-von Mises statistics were utilized to evaluate the goodness-of-fit of a hypothesized theoretical distribution function to a sample of measurements of spatially-varying soil properties. Because normal and log-normal distributions have been commonly used to describe the variability of several soil properties, a Monte Carlo study was performed to determine the sample size required for selecting, with a prescribed level of confidence, between these 2 distributions. It was found that the required sample size increased with decreasing coefficient of variation (CV = standard deviation/mean). However, both normal and log-normal distributions may adequately describe a set of measurements with CV equal to or less than 0.4. In such cases, it was shown that accepting normal distribution as the appropriate distribution when the true distribution is, in fact, log-normal would involve a maximum error of about 20% when the mean is used instead of the mode. (Humphreys-ISWS)
W79-07143

DRAINAGE WATER SAMPLING IN A WET, DUAL-PORE SOIL SYSTEM,
Centre County Planning Commission, Bellefonte, PA.
K. A. Shaffer, D. D. Fritton, and D. E. Baker.
Journal of Environmental Quality, Vol. 8, No. 2, p 241-246, April-June 1979. 2 fig, 5 tab, 12 ref.

Descriptors: *Water sampling, *On-site tests, *Leachate, *Pennsylvania, Testing procedures, Nitrates, Cadmium, Soil water, Loam, Silts, Methodology, Water analysis, Instrumentation, Hublersburg silt loam.

Two experiments were conducted on an undisturbed Hublersburg silt loam (Typic Hapludult) soil to evaluate 2 different soil solution sampling techniques. The 2 techniques were employed simultaneously to sample the leachate at depths of 38 to 120 cm when water was added at the soil surface with known concentrations of NO3-N (0-579 ppm) and Cd(2+) (0.0001-5.45 ppm). After each controlled water addition to the surface, soil water samples were taken for analysis with porous cup soil water samplers and with devices located in a subsurface horizontal tunnel. Large differences in ion concentration occurred between data obtained from the soil water samplers and from the horizontal tunnel. Calculations based on water retention data indicated that in excess of 90% of the total flow occurred in pores drained by water potentials of 0 to -20 cm of water. This pore class is considered to be dominated by interped cracks and to cause a channeling of solution past the porous cup samplers. It was concluded that under wet soil conditions, soil water samplers are not suitable for monitoring the chemical quality of the water percolating through the soil profile. (Humphreys-ISWS)
W79-07153

TRACE ELEMENTS IN FLY ASH AND THEIR RELEASE IN WATER AND TREATED SOILS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-07159

CONSEQUENCES OF WATER MOVEMENT IN MACROPORES,
Kentucky Univ., Lexington. Dept. of Agronomy.
G. W. Thomas, and R. E. Phillips.
Journal of Environmental Quality, Vol. 8, No. 2, p 149-152, April-June 1979. 6 fig, 22 ref.

Descriptors: *Soil water movement, *Solutes, *Soil water, *Infiltration, Percolation, Recharge, Natural recharge, Drainage, Rainfall, Soils, Porosity, Pores, Leaching, Irrigation, Soil science, Macropores.

Current views of infiltration of water into soils are based on nearly complete displacement of soil water by incoming water. In general, rapid flow down macropores and its effect on water and solute distribution have not been considered very important by the majority of researchers. Evidence was presented to show that flow of water through macropores is important in soil and groundwater recharge and in salt movement through soils. (Sims-ISWS)
W79-07161

EVIDENCE OF FISH SURVIVAL DURING HABITAT DESSICATION IN RHODESIA,
Department of National Parks and Wildlife Management, Causeway (Rhodesia). Rhodes Matopos National Park.
B. G. Donnelly.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 75-76, July 1978. 1 ref.

Descriptors: *Fish behavior, *Aquatic environment, *River beds, *Dry beds, *Dry seasons, *Vertical migration, Wildlife, Wildlife habitats, Rhodesia.

From March onward many Rhodesian rivers being to dry out, leaving a dry sandy river bed apparently devoid of fish. Data are reported from 14 observations which suggest a behavioral adaptation by S. mossambicus, Clarias gariepinus, Engraulicypris brevianalis which allows them to survive when the rivers dry out. The fish may be able to burrow into wet sand and stay alive for several months by maintaining contact with the subsurface water table. During excavations of the dry sandy river beds fish have been found in the sand up to a depth of 6 m. Future research investigations are recommended concerning the oxygen values at the depth

where fish are found, and the acclimation by these fish to long periods of complete darkness, little movement, and no food. (Davison-IPA)
W79-07189

CALCULATION OF SATURATED HYDRAULIC CONDUCTIVITY OF SOME PEDAL CLAY SOILS USING MICROMORPHOMETRIC DATA,
Soil Survey Inst., Wageningen (Netherlands). Dept. of Micropedology.
J. Bouma, A. Jongerius, and D. Schoonderbeek.
Soil Science Society of America Journal, Vol. 43, No. 2, p 261-264, March-April 1979. 2 fig, 3 tab, 10 ref.

Descriptors: *Hydraulic conductivity, *Saturated flow, *Soil properties, Laboratory tests, Analytical techniques, Microscopy, Soils, Clays, Soil water, Soil water movement, Mathematical models, Data processing, Soil science, Soil swelling.

The saturated hydraulic conductivity (K sub sat) was calculated for undisturbed freeze-dried samples of 7 clay soils by using micromorphometric Quantimet data. Voids were characterized in terms of quantity (number and length), type, and directly measured size. Methylene blue was used to indicate flow patterns. A statistical planar and tubular void-interaction model was used to estimate sizes of 'necks' in the flow system, which were assumed to determine K sub sat. Measured K sub sat values were within the calculated K sub sat range, when relatively large, vertically continuous tubular voids were not present. Very small variations of the width of planar 'necks' had a strong effect on the magnitude of K sub sat. Soil which was moist when sampled had larger planar 'necks' and higher K sub sat values than soil which had been in wet condition for several months. This difference was attributed to the effects of soil swelling. In general, volumetric percentages of active (stained) voids (estimated by % surface area) were less than 1. This illustrates the basic difficulty of estimating K sub sat in clay soils by methods which use relative volumes of voids. (Sims-ISWS)
W79-07212

BORON DISTRIBUTION IN SOILS AND WATERS OF EGYPT,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
For primary bibliographic entry see Field 2K.
W79-07230

THE EFFECT OF ACID MINE DRAINAGE WATER ON TWO PENNSYLVANIA SOILS,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W79-07251

BACTERIAL EFFECTS ON HYDRAULIC CONDUCTIVITY OF SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
W. T. Frankenberger, Jr., F. R. Troeh, and L. C. Dumenil.
Soil Science Society of America Journal, Vol. 43, No. 2, p 333-338, March-April 1979. 5 fig, 7 tab, 17 ref.

Descriptors: *Hydraulic conductivity, *Soils, *Soil water movement, *Bacteria, Laboratory tests, Soil water, Microorganisms, Pores, Metabolism, Soil bacteria, Aerobic bacteria, Anaerobic bacteria, Nutrients, Leaching, Phosphorus compounds, Biological communities, Biological properties, Soil science.

Laboratory experiments were performed to determine the relationship between bacterial pore clogging and soil hydraulic conductivity. When soils were submerged and hydraulic conductivity was plotted against time, the conductivity decreased and eventually stabilized at a constant value. The time required, the stable value, and the coefficient of variability (CV) were all influenced by the treatment applied to the soil. Sterile soils had the highest hydraulic conductivity and lowest CV of all treatments. Continuous submergence and wetting and drying cycles were compared in their effects on hydraulic conductivity. A specific portion of the total biological activity (as determined by the acid phosphatase assay) and a selective bacterial population (accounted for by the medium used) were significantly and negatively correlated with hydraulic conductivity. As the bacterial population and phosphatase activity increased, the hydraulic conductivity decreased. The decrease in hydraulic conductivity under prolonged periods was due primarily to the excretion of metabolic products produced by bacteria within the soil pores. (Sims-ISWS)
W79-07266

DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS: II. EXPERIMENTAL,
Colorado State Univ., Fort Collins; and Science and Education Administration, Fort Collins, CO.
T. K. Glas, A. Klute, and D. B. McWhorter.
Soil Science Society of America Journal, Vol. 43, No. 2, p 268-273, March-April 1979. 5 fig, 2 tab, 18 ref. OWRT A-017-COLO(3).

Descriptors: *Leaching, *Laboratory tests, *Model studies, *Kinetics, Porous media, Gypsum, Soils, Methodology, Movement, Dispersion, Solutes, Analysis, Chemical reactions.

Experimental information on the dissolution of gypsum and the subsequent transport of the dissolved species in a soil-water system was obtained by adding distilled water to the top of 30-cm long columns containing a soil-gypsum mixture and by measuring the calcium concentration in the solution phase as a function of time at different positions in the columns. The measured concentration-time curves were compared with results from 2 models--the first based on equilibrium chemical principles and the mixing-cell concept, and the second model based on a combination of the one-dimensional convection-dispersion equation and a first-order kinetic expression describing the dissolution process. Under the specific experimental conditions studied, the dissolution process appeared to be kinetically controlled and could not be described by the solubility-product relationship. (Humphreys-ISWS)
W79-07284

DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS: I. THEORY,
Colorado State Univ., Fort Collins; and Science and Education Administration, Fort Collins, CO.
T. K. Glas, A. Klute, and D. B. McWhorter.
Soil Science Society of America Journal, Vol. 43, No. 2, p 265-268, March-April 1979. 4 fig, 14 ref.

Descriptors: *Leaching, *Model studies, *Porous media, *Kinetics, Mathematical models, Theoretical analysis, Analytical techniques, Mathematics, Gypsum, Chemical reactions, Equations, Soils, Movement, Dispersion, Infiltration, Solutes.

A model was developed describing the dissolution and subsequent transport of gypsum from a soil column by combining the one-dimensional convection-dispersion equation with a kinetic expression for the dissolution process. The resulting partial differential equations were solved numerically by the method of lines. Results were presented showing the effect of the various parameters in the model on calculated concentration-time curves. (Humphreys-ISWS)
W79-07285

EXPERIMENTAL INVESTIGATION OF THE PENETRATION COEFFICIENT IN CAPILLARY TUBES,
Louvain Univ. (Belgium). Dept. de Genie Rural.
R. S. Malik, Ch. Laroussi, and L. W. De Backer.
Soil Science, Vol. 127, No. 4, p 211-218, April 1979. 7 fig, 3 tab, 8 ref.

Descriptors: *Penetration, *Capillary conductivity, *Capillary action, *Model studies, Laboratory tests, Flow, Theoretical analysis, Tubes, Density, Gravity, Surface tension, Velocity, Time, Darcys law, Graphical analysis, Evaporation, Condensation, Penetration coefficient, Capillary tubes, Poiseuilles law.

Parameters influencing the penetration coefficient lambda were experimentally investigated by causing various liquids to flow in horizontal, straight glass capillaries of different radii. The conductivity of the capillary tube remains constant during the flow and is defined in terms of penetration coefficient, density, gravity, capillary radius, surface tension, and contact angle. The relationship between the square root of time and the penetration distance was found to hold true for the whole period studied. The experimental and theoretical values of both penetration coefficient and conductivity compared favorably and verified the validity of Poiseuille's law in unfilled capillaries. Theoretical proportionality between the square of the penetration coefficient and the capillary radius, on the one hand, and liquid properties in terms of sigma cos alpha sub a/micron, on the other, was found to be experimentally true. Experimental values of the penetration coefficient matched those calculated theoretically from handbook data when using the contact angle calculated from the capillary height reached by the advancing meniscus. (Visocky-ISWS)
W79-07317

A NEW NUMERICAL SOLUTION OF UNSTEADY TWO-DIMENSIONAL FLOW IN UNSATURATED POROUS MEDIA,
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
B. H. Caussade, G. Dournes, and G. Renard.
Soil Science, Vol. 127, No. 4, p 193-201, April 1979. 6 fig, 2 tab, 9 ref.

Descriptors: *Unsaturated flow, *Porous media, *Unsteady flow, *Numerical analysis, *Soil water movement, Mathematical models, Equations, Infiltration, Drainage, Alternate linear-nonlinear method.

A numerical alternate linear-nonlinear method for solving two-dimensional, unsteady infiltration of water in unsaturated soils was presented. The results compare favorably with previously published results obtained by conventional numerical methods on similar examples. (Visocky-ISWS)
W79-07318

CROP RESIDUE EFFECTS ON RUNOFF,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center; and Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W79-07338

A SIMPLE SOIL HEAT FLUX CALCULATION FOR NUMERICAL MODELS,
National Weather Service, Silver Spring, MD. Techniques Development Lab.
W. A. Shaffer.
NOAA Technical Memorandum NWS TDL 68, May 1979. 14 p, 6 fig, 8 ref.

Descriptors: *Soil temperature, *Energy equation, *Mathematical models, Heat flow, Energy balance.

An analytic solution of the heat equation is the basis for a scheme to compute the soil heat flux needed for a surface energy balance calculation. An initial soil temperature profile and constant thermal properties are assumed. No vertical computational levels within the soil are used or needed. The scheme is inherently accurate, since it is derived from an analytic solution and is immune from the problems of spatial truncation error and numerical instability associated with finite-difference techniques. Two simplifications of the scheme are presented that reduce computer storage requirements and the number of computations, allowing the scheme to be applied to models with a wide range of time steps. (NOAA)
W79-07370

2H. Lakes

IMPACT OF GREAT LAKES WATER LEVEL FLUCTUATIONS ON COASTAL WETLANDS,
Eastern Michigan Univ., Ypsilanti. Dept. of Geography and Geology.
E. Jaworski, C. N. Raphael, P. J. Mansfield, and B. B. Williamson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 403, Price codes: A16 in paper copy, A01 in microfiche. Project Completion Report Institute of Water Research, Michigan State University April, 1979. 363 p. OWRT B-045-MICH(1), 14-0001-7163.

Descriptors: *Wetlands, *Water level fluctuations, Succession, Plant communities, Models, Diking, Coastal management, Aerial photography, *Great Lakes, Oconto River(WI), Betsie River(MI), Tobico Marsh(MI), Tuscola Wetlands(MI), Dickinson Island(MI), Woodtick Peninsula(MI), Toussaint Marsh(OH).

Field measurements were collected over a two-year period at seven study areas along Lakes Michigan, Huron, St. Clair, and Erie. Surface landforms were mapped, and models of the four coastal wetland types were developed. With the aid of aerial photography and field bisects, the zonal plant communities were identified and three historical distribution maps were constructed which represented various lake level conditions. Field data indicate that water level, wave energy, and substrate type are important factors in determining the shifting of plant communities in response to lake level fluctuations. A plant community displacement model reveals that most of the shrub and some of the meadow communities tend to persist at any lake level, but that emergent, floating-leaved, and submersed aquatics are displaced by other communities or by open water. As the plant communities shift in response to water level changes, the value and function of the wetland system changes. Although diking may protect coastal wetlands from wave erosion and inundation during high water, as well as provide protection from polluted land drainage, structural management reduces the multiplicity of wetland uses and functions, particularly with regard to fish habitat values and hydrological functions.
W79-07001

A FILLING-BOX MODEL OF RIVER-DOMINATED LAKES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
P. D. Killworth, and E. C. Carmack.
Limnology and Oceanography, Vol. 24, No. 2, p 201-217, March 1979. 12 fig, 24 ref.

Descriptors: *Lakes, *Rivers, *Model studies, Mathematical models, Inflow, Discharge(Water), Temperature, Water temperature, Stratification, Density, Pollutants, Path of pollutants, Dynamics, Mixing, Heat transfer, Hydrology.

A dynamical model of river-lake interaction was used to quantitatively examine the physical behavior of the Kamloops Lake-Thompson River system in British Columbia. The analysis was based on the so-called filling-box method which predicts the thermal stratification of the lake relative to hydrological conditions; specifically the river's effect on thermocline formation and decay, convective overturn, heat exchange, and particle residence time were examined. The model can be used to simulate the effects of hypothetical developments in the watershed and to examine physical processes relevant to the release of pollutants upstream. (Sims-ISWS)
W79-07105

ACOUSTICAL ESTIMATION OF ZOOPLANKTON POPULATIONS,
Oregon State Univ., Corvallis. School of Oceanography.
C. F. Greenlaw.
Limnology and Oceanography, Vol. 24, No. 2, p 226-242, March 1979. 12 fig, 19 ref.

Descriptors: *Remote sensing, *Zooplankton, *Acoustics, Plankton, Aquatic microorganisms, Aquatic life, Particle size, Equipment, Surveys, On-site investigations, Biomass, Biology, Limnology, Euphausiids, Backscattering, Backscattering cross-sections.

Acoustical estimates of zooplankton abundance can be made rigorously if the scattering behavior as a function of size and frequency for the zooplankters is known. Measurements of scattering at a single frequency can be used to estimate abundance if the mean zooplankter size is known. Measurements at two frequencies can be used to estimate the dominant size as well as abundance if a single size zooplankter dominates the acoustical scattering. Measurements at several frequencies can be used to estimate size distributions and abundances. In a field experiment, acoustical scattering was measured at three frequencies for zooplankton layers composed largely of euphausiids (for which an approximate scattering model is known). These data were analyzed by each method and estimates of numerical abundance given. (Sims-ISWS)
W79-07120

DISSOLVED OXYGEN MODEL OF A SHORT DETENTION TIME RESERVOIR WITH ANAEROBIC HYPOLIMNION,
Iowa Univ., Iowa City. Dept. of Environmental Engineering.
J. L. Schnoor, and E. G. Fruh.
Water Resources Bulletin, Vol. 15, No. 2, p 506-518, April 1979. 7 fig, 14 ref.

Descriptors: *Dissolved oxygen, *Texas, *Reservoirs, *Hypolimnion, *Model studies, Mathematical models, Water quality, Ammonia, Biochemical oxygen demand, Conductivity, Temperature, Water temperature, Sediments, Lakes, Inflow, Discharge(Water), Evaporation, Rain, Diffusion, Phytoplankton, Limnology, *Lake Lyndon B Johnson(TX).

A vertical dissolved oxygen model was calibrated and verified using independent field data sets from 1972 and 1973 in Lake Lyndon B. Johnson, a short detention time reservoir with anaerobic hypolimnion. Ammonia, Carbonaceous BOD, conductivity, and temperature were also simulated as state variables. The conductivity results provided a check on the mass balance and the method of entering the inflows to the reservoir model. Emphasis was placed on calculating the sinks of dissolved oxygen in the hypolimnion which could be useful in management decisions. (Sims-ISWS)
W79-07121

RESPONSE OF HALEY POND, MAINE, TO CHANGES IN EFFLUENT LOADS,
Maine Dept. of Environmental Protection, Augusta.
For primary bibliographic entry see Field 5D.
W79-07147

FINITE ELEMENT ANALYSIS OF THREE-DIMENSIONAL WIND-DRIVEN FREE SURFACE FLOWS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 4A.
W79-07165

THE EFFECT OF AGITATION AND TURBULENCE OF THE GROWTH MEDIUM ON THE GROWTH AND VIABILITY OF MICROCYSTIS,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
G. H. J. Kruger, and J. N. Eloff.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 69-74, July 1978. 1 fig, 2 tab, 22 ref.

Descriptors: *Algae, *Plant population, *Flowering, *Growth rates, *Turbulence, *Viability, Cultures, Laboratory tests, Impounded waters, Turbidity currents, Light intensity, Laboratory equipment, Velocity.

Because observations of natural blooms of Microcystis suggested that turbulence retarded bloom formation, experiments were performed to investigate the effect of agitation on the growth of Microcystis with respect to the axenic mass culture of this alga in the laboratory, and to examine the ecological effects of turbulence. Laboratory cultures were agitated by means of magnetic stirrers placed under the flasks in which inert magnetic followers were placed. The cultures were agitated at speeds corresponding to linear velocities of 25, 75, 126, 209, and 314 cm sec to the minus one. This turbulence had no adverse effect on the growth of M. UV-007. The linear velocity showed a highly significant correlation with the percentage viability as determined by a plating and serial dilution method. The viability ranged from 0.8% to 99.2% for the stationary cultures and the vigorously stirred cultures, respectively. (Davison-IPA)
W79-07188

ACCUMULATION OF POLYCHLORINATED BIPHENYLS (PCBS) IN SURFICIAL LAKE SUPERIOR SEDIMENTS. ATMOSPHERIC DEPOSITION,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 5B.
W79-07332

MIREX AND THE CIRCULATION OF LAKE ONTARIO,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5B.
W79-07334

COMBINED INFLUENCE OF INFLOW AND LAKE TEMPERATURES ON SPRING CIRCULATION IN A RIVERINE LAKE,
National Water Research Inst., Vancouver (British Columbia). Pacific and Yukon Region.
E. C. Carmack.
Journal of Physical Oceanography, Vol. 9, No. 2, p 422-434, March 1979. 14 fig, 1 tab, 18 ref.

Descriptors: *Lakes, *Canada, *Circulation, *Stratification, Inflow, Discharge(Water), Rivers, Temperature, Water temperature, Density, Spring, Convection, Heat transfer, Mixing, Sampling, Data processing, Mathematical models, Limnology, *Kamloops Lake(British Columbia).

Kamloops Lake is a long (25 km), deep (maximum depth, 145 m) intermontane lake in central British Columbia fed at its eastern end by the Thompson River (mean annual flow, 720 cu m/s). The spring overturn and the onset of stratification were described on the basis of three conceptual models, distinguishing among river-induced, surface-induced, and edge-induced circulations. The lake during winter is characterized by weak reverse stratification; the incoming river waters are less dense than ambient lake water and thus tend to remain at the lake surface. During spring, the shallow river water warms more rapidly than the deep water of the lake; as inflow water warms toward the temperature of maximum density (4C), it becomes denser than lake water and thus tends to sink on entry into the lake. Further warming of the inflow water above 4C decreases its density causing it to again enter the lake as a surface overflow. Although the inflow itself is less dense than lake water, some mixtures of the two will necessarily have temperatures near 4C, and thus be denser than either parent water mass; this process is called cabbeling. The dense mixtures then sink along a narrow frontal zone, filling the lake basin with 4C water from the bottom upward, while new (unmixed) inflow water is held as an arrested wedge near the point of entry. (Sims-ISWS)
W79-07336

SOME STEADY STATE EXACT SOLUTIONS OF THE WIND-DRIVEN CIRCULATION EQUATIONS FOR A RIGID-LID SHALLOW LAKE,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
A. Giorgini.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 206, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 116, June 1979. 54 p, 34 fig, 5 ref, 2 append. OWRT A-048-IND (1).

Descriptors: *Lakes, *Winds, Lake breezes, Air circulation, Bathymetry, Shear strength, Lake circulation, Mathematical equations, Navier Stokes Equations.

This study presents a method for solving the lake circulation equations under the rigid-lid approximation and for small shallow lakes. The driving force, simulating the wind, is constituted by a one-directional shear whose intensity may be variable across the lake. The method relaxes the bathymetry as a datum and finds it instead, together with the flow field, by suitable constraints on the flow field itself. The most interesting case of uniform surface shear (uniform wind intensity) is studied for the following subcases: (1) a lake; (2) an underwater hill in an otherwise constant-depth water body of infinite horizontal extent; (3) an underwater pool in an otherwise constant-depth body of infinite horizontal extent.
W79-07425

HYDROLOGICAL SETTING AND WATER QUALITY OF THE URBAN ARTIFICIAL SANDPIT LAKE 'SLOTERPLAS' AT AMSTERDAM,
Vrije Univ., Amsterdam (Netherlands). Inst. of Earth Sciences.
G. B. Engelen, and B. F. M. Kal.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 315-323, 1977. 6 fig, 5 ref.

Descriptors: *Hydrological aspects, *Water quality, *Artificial lakes, *Sand pits, *Water balance, *Sloterplas(Amsterdam The Netherlands), Water pollution, Surface waters, Thermal stratification, Eutrophication, Anaerobic conditions.

The Sloterplas is a lake covering an area of 86 ha with a maximum depth of 38 m, situated in the center of the western post-war extension of the city of Amsterdam, within an independent unit in the water management system--the Sloterpolder. Sources of pollution are street refuse washed into the canals through the sewer system, and the inflow of polluted water from the city center through some sluices. The holomictic lake therefore is eutrophic, which is reflected in occasional algal blooms and anaerobic conditions at the bottom during summer stratification. The investigation conducted from April 1974 to March 1975 examined the water balance of the Sloterpolder, the pattern of water quality in the entire surface water system of the polder, and the evolution of the temperature-oxygen stratification in the Sloterplas. The results lead to discerning seven hydrological units within the Sloterpolder. It is concluded that the eutrophication of the lake and possibly a gradual rise in its salt content are caused by the inflow of only small amounts of strongly polluted water and by the application of fertilizers on horticultural areas and sports grounds. The seven hydrological units differ from each other in land use, the water management system, kind of topsoil, and the hydrochemical influence of the Sloterplas. (See also W79-07426) (Bell Graf-Cornell)
W79-07460

2I. Water In Plants

RAINFALL ADDITAMENTS TO SUBSURFACE WATER IN A YOUNG PINE PLANTATION,
West Virginia Univ., Morgantown. Div. of Forestry.
S. J. Tajchman, R. Lee, and E. W. Repa.
Water Resources Bulletin, Vol. 15, No. 2, p 381-386, April 1979. 2 fig, 2 tab, 7 ref.

Descriptors: *Forests, *Rainfall, *Water, Rain, Subsurface waters, Pine trees, Interception, Throughfall, Plant populations, Scotch pine trees, Canopy, Effective precipitation, Gages, *Rhine River, *Gross rainfall, Pine plantation, Forest canopy, Forest ecosystem, Forest density, Trough gages.

Effective rainfall is virtually equal to throughfall under most forest canopies. Average throughfall (as measured in trough gages for a series of rainfall events) increases systematically with distance from tree stems in a young pine plantation. Empirical data suggested that the increase is proportional to the fourth root of distance, but any physical meaning of the relationship is obscure. The relationship may be simply a fortuitous result associated with the curve-fitting operation. It is undoubtedly a function of lead area and canopy structure, but could not be defined in terms of the volume of a conical canopy above observation points. (Roberts-ISWS)
W79-07117

CORN YIELD RESPONSES TO WATER STRESS MANAGEMENT,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
E. C. Stegman, and M. Aflatouni.
Paper No. 78-2558, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 9 p. 8 fig, 3 tab, 18 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Moisture stress, Evapotranspiration, *Crop response, Corn, Moisture deficit, Growth stages, Irrigation systems.

Relative yield (Y/Ymax) vs. relative evapotranspiration (ET/ETmax) functions were defined for major growth periods. These functions also suggested some yield loss may occur due to water stress before an ET depression necessarily also occurs. Relative yield attainment was also related to minimum levels of leaf xylem pressure just prior to stress relief in given growth stages. (Skogerboe-Colorado State)
W79-07500

2J. Erosion and Sedimentation

GRAIN-SIZE DISTRIBUTION OF SUSPENDED LOAD IN RELATION TO BED MATERIALS AND FLOW VELOCITY,
Indian Statistical Inst., Calcutta. Geological Studies Unit.
S. Sengupta.
Sedimentology, Vol. 26, No. 1, p 63-82, February 1979. 13 fig, 3 tab, 22 ref.

Descriptors: *Suspended load, *Flow, *Particle size, *Velocity, Streamflow, Flumes, Sands, Erosion, Sediment transport, Hydraulics, Sediments, Size, Distribution, *Grain-size distribution, Bed materials, Sand beds, Laboratory flume.

Grain-size frequency distributions of suspended loads at different flow velocities and over sand beds of 4 different grain-size patterns were studied in a laboratory flume. The proportion of bed material which went into suspension increased with decrease of grain-size in each case, but the modes of the suspended loads occurred in the size classes intermediate between the coarsest and the finest. With increase of flow velocity, as also with decrease of the bed's mean grain-size, the total amount of material in suspension markedly increased, mainly due to addition of particles to the medium size classes. The coarsest grains in the bed resisted erosion due to their weight, whereas the finest ones were either not available in sufficient quantities or resisted erosion due to their homogeneity. The finest of the erodible grains which were abundantly available in bed were lifted up in large quantities. This size sorting took place at or near the bed surface and was closely related to the process of bed form migration. Large accumulation of medium sized particles in suspension at high velocities led to lognormal grain-size distributions when the nature of the bed (source) material was suitable. At lower velocities, or over other types of bed materials, the phi (log)-probability plots of cumulative grain-size distributions of the suspended loads resolved into a number of straight lines. Mixtures of linear segments on phi-probability graphs, therefore, need not necessarily indicate different modes of sediment transportation, as is commonly believed, but might reflect the conditions of flow and the nature of the source material. (Lee-ISWS)
W79-07050

THE CONVERGENCE OF IMPLICIT BED TRANSIENT MODELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-07107

STEEPNESS OF SEDIMENTARY DUNES,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
M. S. Yalin, and E. Karahan.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14502, p 381-392, April 1979. 5 fig, 1 tab, 15 ref, 2 append.

Descriptors: *Beds, *Sediments, *Sand waves, *Model studies, Mathematical models, Dunes, Rivers, Channels, Open channels, Sediment transport, Sands, Flow, Streamflow, Bed load, Sedimentation, Sedimentary dunes, Steepness.

A family of curves was determined for the prediction of the steepness of dunes generated by rivers and open channel flows by using field and laboratory data from various sources. The dune steepness appeared to be determined by two dimensionless variables: the ratio of the existing bed shear stress to the shear stress inducing the inception of sediment transport, and the ratio of the flow depth to the grain size of sediment. It was found that with the increment of the former variable, the dune steepness first increases, then reaches its maximum value, and then progressively decreases as to vanish asymptotically. The increment of the second variable causes only the increment of the dune steepness up to a certain upper limit. (Sims-ISWS)
W79-07109

THE DESIGN OF SEDIMENT BASINS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
A. D. Ward, C. T. Haan, and B. J. Barfield.
Paper No. 78-2086, Presented at the 1978 Summer Meeting of the American Society of Agricultural Engineers, June 27-30, 1978, Logan, Utah, 32 p. 4 fig, 4 tab, 17 ref. ASAE, St. Joseph, Michigan. OWRT B-046-KY(4). 14-34-0001-6081.

Descriptors: *Sediment control, Sediments, *Detention reservoirs, Mine wastes, Regression analysis, Simulation analysis, Computer programs.

Passage of Public Law 95-87 has placed several new restrictions on the design of surface mine sediment basins. It created much controversy as to the required sizing of the sediment basins, and adequate design methods are not available for estimating basin performance and effluent sediment concentrations. This paper presents guidelines as to how the hydrologic parameters affecting sediment basin design may be quantified and contains predictive equations for estimating basin trap efficiency and peak effluent sediment concentrations. Multiple regression analysis techniques were employed with data generated by a hydrograph computer program and by a simulation model. The simulation model has been tested on several actual basins

and appears to give a good estimate of basin performance. It also gave a good estimate of the performance of Callahan Reservoir during a 60-day period in 1973. A new version of the model allows for variation in the particle size distribution with runoff rate. Criteria are presented which account for basins with a permanent pool. Also considered are base flow conditions following a design storm event. (Skogerboe-Colorado State)
W79-07126

LIGHTWEIGHT CORER DESIGNED FOR SAMPLING VERY SOFT SEDIMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. D. H. Williams, and A. E. Pashley.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 3, p 241-246, March 1979. 3 fig, 21 ref.

Descriptors: *Sampling, *Lake sediments, *Core drilling, *Research equipment, Underwater, Sediments, Organic matter, Testing procedures, Bottom sediments, Lakes, Reservoirs, Estuaries, Unconsolidated sediments, Soft sediments.

An underwater corer was developed which is capable of taking 10-cm diam cores up to 1 m long from unconsolidated, fine-grained fluvial and lacustrine sediments including organic-rich (gyttja-like) deposits. The corer is lightweight and compact for transport and hand operation from float planes and small boats. It is of the piston type and has a sphincter valve for core retention. A miniature optical sensor triggers the corer when the sediment-water interface is penetrated. The corer is compatible with a system to subdivide the cores by vertical extrusion. The corer will operate under conditions that preclude a diver, especially great water depths. Under moderately calm conditions, the corer will recover cores from unconsolidated deposits, provided they are at least 30 cm or so thick, in such locations as lakes, reservoirs, lagoons, harbors, and estuaries. The lightweight corer gave total C profiles closest to the diver-taken core. (Humphreys-ISWS)
W79-07134

EROSION OF COHESIVE SEDIMENTS AS RATE PROCESS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. E. Kelley, R. C. Gularte, and V. A. Nacci.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 105, No. GT5, Technical Note, p 673-676, May 1979. 2 fig, 7 ref, 1 append. NSF ENG76-20660.

Descriptors: *Cohesive soils, *Laboratory tests, *Erosion, *Model studies, Sediment transport, Clays, Illite, Sediments, Hydraulic models, Movement, Erosion rates, Grundite.

This study used illitic clay (Grundite) in a water temperature controlled water tunnel. An experimental activation energy of 17 kcal/mole was determined. The experimental activation energies determined compare well with previously published values and suggest that particle interactions are essentially solid to solid. The strength of particle contacts that probably involve a number of bonds will depend on the magnitude of attractive forces that in turn depend on physicochemical factors such as salinity and pH. (Humphreys-ISWS)
W79-07137

INTENSIVE SITE PREPARATION AND SEDIMENT LOSSES ON STEEP WATERSHEDS IN THE GULF COASTAL PLAIN,
Arkansas Univ. at Monticello. Dept. of Forestry.
For primary bibliographic entry see Field 4D.
W79-07140

MULTIPLE-INTENSITY RAINFALL SIMULATOR FOR EROSION RESEARCH ON ROW SIDESLOPES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. D. Meyer, and W. C. Harmon.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 100-103, January-February 1979. 9 fig, 1 tab, 9 ref.

Descriptors: *Rainfall simulators, *Soil erosion, *Research equipment, Simulated rainfall, Equipment, Rainfall intensity, Impact(Rainfall), Sediments, Runoff, Particle size, Erosion, Crops, Agriculture, Agricultural engineering, Row-sideslope erosion.

A rainfall simulator was developed for obtaining data on erosion, runoff, and sediment sizes from rowcrop sideslopes. This research tool can apply a wide range of intensities at impact energies very similar to those of natural rainfall. Results showed that large rates of erosion may occur from row sideslopes and that sediment sizes often differ greatly from soil textural sizes. (Sims-ISWS)
W79-07146

INITIATION OF RIPPLE MARKS UNDER OSCILLATING WATER,
Kyushu Univ., Fukuoka (Japan). Research Inst. for Applied Mechanics.
A. Kaneko, and H. Honji.
Sedimentology, Vol. 26, No. 1, p 101-113, February 1979. 7 fig, 1 tab, 6 ref.

Descriptors: *Ripple marks, *Flow, *Waves(Water), Sand waves, Sediment transport, Hydraulics, Sedimentation, Equations, Mathematical studies, Mathematics, *Oscillating water, Sand beds, Oscillatory boundary layer.

It was observed that a monolayer of glass beads which were scattered sparsely on a rigid plane floor grew into regular waves of particles under oscillatory water flow. The relative displacement of two nearby particles due to viscous fluid forces seems to be responsible for the initiation of these particle waves. It was also observed that the similar particle waves were formed on the initially flat surface of a thick sand bed and subsequently developed into oscillatory sand ripples of a common type. On the basis of these observations, it was suggested that the particle waves may be the basic cause of the initiation of general ripple marks under oscillatory flow. (Lee-ISWS)
W79-07151

ADDRESS OF THE RETIRING PRESIDENT OF THE INTERNATIONAL ASSOCIATION OF SEDIMENTOLOGISTS: DIFFERENCES IN SIZE DISTRIBUTIONS OF POPULATIONS OF PARTICLES AMONG SANDS OF VARIOUS ORIGINS,
Rensselaer Polytechnic Inst. Troy, NY. Dept. of Geology.
G. M. Friedman.
Sedimentology, Vol. 26, No. 1, p 3-32, February 1979. 31 fig, 1 tab, 34 ref.

Descriptors: *Gulf of Mexico, *Texas, *Louisiana, *Mississippi, *Alabama, *New Jersey, *Oklahoma, *Sands, *Distribution, *Reviews, *Data collections, Particle size, Spatial distribution, Rivers, Coasts, Beaches, Dune sands, Sand bars, Statistical methods, Analysis, Size, Gradation, Continental shelf, Analytical techniques, Geomorphology, *Padre Island(TX), *Arkansas River, Size-frequennecy distributions.

This paper reviewed the effect of depositional processes on various parameters of the size-frequency distribution of sands. Movements of air and water generally separate particles by their sizes; the distribution of sizes relates to (1) the availability of different sizes of particles in a parent material, (2) processes operating where the sediments are deposited, particularly the competency of flow, and (3) concentrations of particles in suspension. Differences in size-frequency distributions among sands correlate with various origins, that is with their terminal depositional environments. The paper re-emphasized some points made in previous studies on the interrelationship between textural parameters and depositional processes for beach, dune, and river sands and then complements and supplements data which have not been presented before. These new data were grouped on scatter plots for sands of various origins. Maps presented regional trends of process-induced changes in size distributions of populations of particles in sands of 4 different settings: (1) a beach-dune setting, as exemplified by Padre Island, Texas, on the shores of the Gulf of Mexico; (2) a point-bar setting in the Arkansas River of Oklahoma; (3) a continental shelf-slope setting in the Gulf of Mexico off Louisiana, Mississippi, and Alabama; and (4) a continental shelf setting of the western Atlantic Ocean off New Jersey. The observation was made that the distribution of particles in sands will be influenced by the conditions that determine what happens in the depositional environment, hence statistical parameters that define the size-frequency distribution may be related to formative process. (Humphreys-ISWS)
W79-07152

14C ASSIMILATION IN A TURBID MAN-MADE LAKE,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Science.
P. Stegmann.
South Africa Journal of Science, Vol. 74, No. 5, p 189-190, May 1978. 1 fig, 1 tab, 5 ref.

Descriptors: *Photosynthesis, *Turbidity, *Light penetration, *Euphotic zone, *Light intensity, *Impoundments, Silting, Reservoirs, Reservoir silting, Depth, Sampling, Instrumentation, Opacity, Optical properties, Secchi disks, South Africa.

Estimates of the photosynthetic activity, or primary production, were carried out in the turbid impoundment of Verwoerd Dam from January to April 1974 when the volume of the dam and the silt content varied greatly. In clear waters the photosynthetic compensation point occurs at a depth where the light intensity is 1% of the light at the surface. Using axenic algal cultures, active carbon assimilation was found at depths five times greater than the 1% light intensity depth in Verwoerd Dam. Samples were taken at monthly intervals from nine fixed depths at three stations. The 1% light intensity depth varied at this time from 17 to 186 cm; and the Secchi disk reading varied from 4 to 31 cm. It appeared that when the turbidity of the water increased bringing about a decrease in the euphotic zone, high rates of primary production took place well below the 1% light intensity depth. Carbon assimilation, due to natural plankton or microbial populations, did not decrease uniformly with depth, but peaked at two definite depths. Photosynthetic activity above the 1% light intensity depth correlated with the euphotic zone, while photosynthetic activity below the 1% light intensity depth showed no correlation with the measured euphotic zone, indicating that some other mechanism may be responsible for the increased carbon assimilation. The results of the investigation indicate that the depth distribution of the photosynthetic activity in a turbid impoundment is different from that in clear water lakes. (Davison-IPA)
W79-07178

LAKE ERIE NEARSHORE SEDIMENTS, POINT PELEE TO PORT BURWELL, ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
N. A. Rukavina, and D. A. St. Jacques.
Scientific Series No. 99, 1978, 44 p, 10 fig, 42 ref, 3 app.

Descriptors: *Sedimentation, *Sediment transport, *Bottom sampling, *Bathymetry, *Sounding, Geology, Glacial sediments, Mapping, Water levels, On-site tests, Laboratory tests, Photography, *Point Pelee, *Port Burwell, Port Glasgow, Ontario.

Bottom samples, echo-sounder records and underwater photographs were used to map the surficial geology and bathymetry of the Lake Erie nearshore zone (0-20 m) from Point Pelee to Port Burwell, Ontario. Bedrock does not outcrop in the study area. The glacial deposits are exposed

throughout most of the zone between Point Pelee and Rondeau and between Port Glasgow and Port Burwell. Inshore exposures tend to be tills and offshore exposures, glaciolacustrine sediments. Postglacial sediments occur as two major deposits offshore from Point Pelee and Rondeau and as a number of smaller inshore and offshore deposits between Port Glasgow and Port Burwell. The average texture of the postglacial sediment is 1% gravel, 30% sand, 34% silt and 35% clay; average thickness is 4m. Accumulation patterns of littoral sediment and textural trends within the major deposits were used to determine the source and transport directions of the postglacial sediments. Sediment is derived primarily from eroding shore bluffs between Pelee and Rondeau and east of Port Glasgow. Dispersal of the coarse fraction takes place by littoral drift directed towards Pelee, Rondeau and Long Point with reversals just east of Port Alma and at Port Glasgow. Fine grained sediments are moved as suspended load either directly into the basin or alongshore to the points and then basinward. (WATDOC)
W79-07224

AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL UNDER SECTIONS 208 AND 303 OF THE CLEAN WATER ACT: HAS FORTY YEARS OF EXPERIENCE TAUGHT US ANYTHING,
For primary bibliographic entry see Field 6E.
W79-07248

SOME ENVIRONMENTAL AND ECONOMIC EFFECTS OF ALTERNATIVE FOREST ROAD DESIGNS,
Intermountain Forest and Range Experiment Station, Bozeman, MT. Forestry Sciences Lab.
R. B. Gardner.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 63-68, January-February 1979. 6 fig, 3 tab, 6 ref.

Descriptors: *Forests, *Roads, *Erosion, Slopes, Slope stability, On-site investigations, Erosion control, Drainage, Sediments, Design, Soils, Trafficability, Costs, Standards, Construction, Effects, Civil engineering.

Esthetic degradation and erosion constitute the major environmental impacts of forest roads. Recent observations from an experimental road in Montana showed that impacts are strongly related to road cross section width: cut slope, road surface and fill slope, and the attendant clearing. To reduce impacts, a single-lane road was constructed to carry all traffic, including log hauling. Hauling was simulated for 3 other road standards and compared with the experimental road. In this instance, where 6,787 cu m (1.5-million board feet) of timber was harvested, the single-lane road was probably the best choice. (Sims-ISWS)
W79-07286

SEDIMENT TEXTURE,
Texas Univ. at Austin, Port Aransas. Geophysical Lab.
E. W. Behrens, B. E. Aleman, K. M. Berg, S. F. Chou, and D. R. Muller.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 7-1 - 7-17, January 15, 1979. 1 fig, 1 tab, 3 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Sediments, *Water pollution sources, *Seasonal, *Variability, Benthos, Environmental effects, Resources development, *Outer Continental Shelf, Substrate, Sediment texture, South Texas Outer Continental Shelf(STOCS).

During 1977, 576 samples representing 6 replicates at each of 25 line and four bank stations sampled during each of 3 seasons (winter, spring, and fall) and 18 miscellaneous samples per season taken for mycological and bacteriological studies were analysed for sediment texture with results reported as mean grain size, standard deviation, skewness, kurtosis (moment parameters) and percentages of sand, silt, clay, and fine clay. The purpose of these data was to provide substrate textural data for benthic organism studies. The samples also provided analyses of textural variability which generally increased from a low at the outer shelf edge to a maximum just seaward of the boundary between shoreface sands and offshore muddy bottoms and then decreased again as sand became dominant shoreward. Five stations are interpreted as having significant seasonal changes. The most consistent pattern seems to have been a general coarsening in muddy sand bottoms of the inner shelf especially between winter and spring sampling. This supports a suggestion of this trend observed in 1976; but a similar trend on the outermost shelf observed in 1976 was poorly supported. (See also W79-07287) (Sinha-OEIS)
W79-07294

MODEL STUDIES AID POND DESIGN,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
A. D. Ward.
Water and Wastes Engineering, Vol. 16, No. 5, p 36-38, May 1979. 2 fig, 2 tab.

Descriptors: *Reservoir silting, *Trap efficiency, *Ponds, *Maryland, *Mathematical models, Deposition(Sediments), Sediment control, Model studies, Hydrographs, Hydraulics, Equations, Estimating equations, Analytical techniques, Sediment transport, Sediment discharge, Detention reservoirs.

Design methods for estimating performance of small ponds suitable for variable flow or storm events have been developed during several ongoing research projects at the Agricultural Engineering Department at the University of Kentucky. Most current methods for estimating performance of small ponds are only suitable for application during steady flow conditions. A conceptual model has been developed which simulates the sedimentation process in reservoirs and sediment detention structures. The Deposits model estimates the trap efficiency of the pond and simulates sediment outflow concentrations as a function of basin geometry, sediment physical properties, inflow hydrograph, inflow sedimentgraph, and basin hydraulic characteristics. Sediment accumulations in the pond and the effects of reduced storage volume on pond performance may also be evaluated. Inputs are few, and virtually no calibration is required. A number of verification studies have been conducted with the model, and in all cases it gave good estimates of basin performance. The types of structures evaluated included a small agricultural reservoir in Missouri, several surface mine ponds in the Appalachian Coal Province, and a sediment pond a stormwater retention pond in Maryland. (Humphreys-ISWS)
W79-07313

MIREX AND THE CIRCULATION OF LAKE ONTARIO,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5B.
W79-07334

CROP RESIDUE, SOIL EROSION, AND PLANT NUTRIENT RELATIONSHIPS,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center; and Minnesota Univ., St. Paul. Dept. of Soil Science.
R. F. Holt.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 96-98, March-April 1979. 4 fig, 2 tab, 11 ref.

Descriptors: *Soil erosion, *Nutrients, *Farm management, *Southeast US, *Oregon, *Corn Belt, Nitrogen, Phoshorus, Potassium, Erosion, Erosion control, Runoff, Wind erosion, Nutrient removal, Crops, Agriculture, *Residue removal, *Crop residue.

Crop residues contain plant nutrients that must be replaced if the residues are removed from the field. Removal of crop residues will increase wind and water erosion, and the eroded sediment will carry plant nutrients with it. The combined nutrient removal in residues and erosion under existing cropping practices would be greater in the Corn Belt than in the Southeast, central Oregon, or the Great Plains. (Sims-ISWS)
W79-07337

CROP RESIDUE MANAGEMENT FOR WIND EROSION CONTROL IN THE GREAT PLAINS,
Science and Education Administration, Manhattan, KS.
For primary bibliographic entry see Field 4D.
W79-07339

TILLAGE AND PLANT RESIDUE MANAGEMENT FOR WATER EROSION CONTROL ON AGRICULTURAL LAND IN EASTERN OREGON,
Science and Education Administration, Pendleton, OR. Columbia Plateau Conservation Research Center.
For primary bibliographic entry see Field 4D.
W79-07340

CROP RESIDUE REQUIREMENTS FOR WATER EROSION CONTROL IN SIX SOUTHERN STATES,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
For primary bibliographic entry see Field 4D.
W79-07341

TILLAGE AND CROP RESIDUE EFFECTS ON SOIL EROSION IN THE CORN BELT,
Science and Education Administration, Morris, MN.
For primary bibliographic entry see Field 4D.
W79-07342

PREDICTING THE EFFECTS OF TILLAGE AND CROP RESIDUE MANAGEMENT ON SOIL EROSION,
Science and Education Admin., St. Paul, MN.
For primary bibliographic entry see Field 4D.
W79-07343

REDUCTION OF SOIL EROSION BY THE NO-TILL SYSTEM IN THE SOUTHERN PIEDMONT,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 4D.
W79-07438

2K. Chemical Processes

HYDROLOGIC DATA FOR WATER-TABLE AQUIFERS IN THE COLORADO SPRINGS--CASTLE ROCK AREA, FRONT RANGE URBAN CORRIDOR, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-07011

ALUMINUM LEACHING RESPONSE TO ACID PRECIPITATION: EFFECTS ON HIGH-ELEVATION WATERSHEDS IN THE NORTHEAST,
Dartmouth Coll., Hanover, NH. Dept. of Biological Sciences.
C. S. Cronan, and C. L. Schofield.
Science, Vol. 204, No. 4390, p 304-306, April 20, 1979. 1 fig, 1 tab, 29 ref. OWRT A-072-NY(2). DEB76-09984, Dept. Engergy EE77-S-02-4498.

Descriptors: *Precipitation(Atmospheric), *Acidic water, *Europe, *United States, *Leaching, *Alu-

minum, *New York, *New Hampshire, Watersheds(Basins), Lakes, Mountains, Soils, Forests, Chemistry of precipitation, Fish, Toxicity, Fish toxins, *White Mountains(NH), *Adirondacks(NY).

Atmospheric inputs of sulfuric acid and nitric acid to noncalcareous higher-elevation watersheds in the White Mountain and Adirondack regions lead to comparatively high concentrations of dissolved aluminum in surface and groundwaters. This phenomenon appears to result from modern increases in soil aluminum leaching. Transport of this aluminum to acidified lakes can lead to fish mortality. Combined results from areas of silicate bedrock in the United States and Europe suggest that aluminum represents an important biogeochemical linkage between terrestrial and aquatic environments exposed to acid precipitation. (Sims-ISWS)
W79-07103

OCCURRENCE AND STABILITY OF CALCITE IN THE MAUMEE RIVER,
Ohio Agricultural Research and Development Center, Wooster. Dept. of Agronomy.
D. B. Green, and N. E. Smeck.
Journal of Environmental Quality, Vol. 8, No. 2, p 182-188, April-June 1979. 4 fig, 4 tab, 17 ref.

Descriptors: *Calcite, *Chemical precipitation, *Rivers, *Ohio, Sampling, Chemicals, Chemical analysis, Calcium, Carbon dioxide, Dolomite, Algae, Suspended solids, Crystals, Chemistry, Water chemistry, *Maumee River(OH).

The occurrence of secondary (precipitated) calcite and the concentrations of parameters controlling calcite dissolution-precipitation were monitored at 6 sites in the Maumee River drainage system during 1975-76. Secondary calcite was identified on the basis of calcite/dolomite ratios as determined by X-ray diffraction and a volumetric procedure employing the Chittick apparatus. Additional evidence for the occurrence of secondary calcite as well as crystal morphology was obtained by optical microscopy. A positive correlation between high calcium concentrations and the occurrence of secondary calcite could not be established; however a relationship between algal blooms and calcite formation was noted. It was concluded that a reduction in the CO2 content of the stream due to algal biomass production is the factor responsible for initiating calcite precipitation in the Maumee River system. Calcite equilibria in the stream are quite dynamic, with secondary calcite appearing and disappearing in relatively short periods of time. (Sims-ISWS)
W79-07158

BORON DISTRIBUTION IN SOILS AND WATERS OF EGYPT,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
A. A. Elseewi, and A. E. Elmalky.
Soil Science Society of America Journal, Vol. 43, No. 2, p 297-300, March-April 1979. 4 fig, 3 tab, 17 ref.

Descriptors: *Boron, *Soils, *Water, Sampling, Chemicals, Chemical analysis, Rivers, Irrigation water, Soil water, Salinity, Chlorides, Acids, Foreign countries, Foreign research, Calcium carbonate, Hydrogen ion concentration, Soil texture, Soil science, *Nile River(Egypt), *Egypt.

Saturation extract, hot water-soluble, acid-soluble, and total B fractions were determined in soil samples from profiles representing 6 geographically diverse areas in Egypt. Saturation extract and hot water-soluble B averaged 0.6 microgram/milliliter and 1.3 microgram/gram. Acid-soluble and total B averaged 10.2 and 113 microgram/gram. The acid fraction showed a curvilinear relationship with CaCO3 content of the soil, and averaged 12.5% of the total B. Total B, on the average, was twice as high in clay samples as in sandy samples, and decreased by about 32% beyond the 60-cm depth of the soil profile. Concentrations of saturation extract B were either similar to or a reasonable multiple of Nile-Water B, indicating that the latter is a direct source of at least water soluble B in these soils. Concentrations of water and acid-soluble B suggest that B status in soils of Egypt is above the sufficiency level, and that under proper soil and water management the incidence of toxicity is unlikely. (Sims-ISWS)
W79-07230

PHOSPHORUS SUPPLYING CAPACITIES OF PREVIOUSLY HEAVILY FERTILIZED SOILS,
Universidade Federal de Vicosa (Brazil). Dept. of Soils.
R. Novais, and E. J. Kamprath.
Soil Science Society of America Journal, Vol. 42, No. 6, p 931-935, November-December, 1978. 3 fig, 7 tab, 22 ref.

Descriptors: *Phosphorus, Soil tests, Soil chemistry, Fertilizers, *Nutrient removal, Chemical analysis, Soil analysis.

Four Coastal Plain soils and one Piedmont soil heavily fertilized in the past were intensively cropped in greenhouse pots to determine changes in extractable soil P as measured by North Carolina, Bray I and Olsen extractants. Slopes relating changes in extractable P with P removed by cropping were very similar for the three sandy soils. Changes in extractable P with the North Carolina and Bray I extractants were correlated with P buffer capacity, % clay, and soil surface area. The principal source of P removed by cropping was NH4F-P in sandy Coastal Plain soils; NH4F-P and NaOH-P supplied equal amounts in the clayey Piedmont soil. Sandy Coastal Plain soils which originally contained more than 74 ppm North Carolina extractable P and 71 ppm Bray I extractable P supplied 82 to 108 kg P/ha to nine crops of pearl millet (Pennisetum americanum, cv. Gahi-1). (Skogerboe-Colorado State)
W79-07492

RESIDUAL NITRATE-N IN FINE SAND AS INFLUENCED BY N FERTILIZER AND WATER MANAGEMENT PRACTICES,
Science and Education Administration, Akron, CO.
For primary bibliographic entry see Field 3F.
W79-07493

THE NITROGEN-15 ABUNDANCE IN A WIDE VARIETY OF SOILS,
Washington Univ., St. Louis, MO. Center for the Biology of Natural Systems.
G. Shearer, D. H. Kohl, and S-H. Chien.
Soil Science Society of America Journal, Vol. 42, No. 6, p 899-902, November-December, 1978. 1 fig, 6 tab, 13 ref.

Descriptors: *Nitrogen, Fertilizers, *Soil chemistry, Sampling, Correlation analysis.

One hundred thirty-nine soil samples from 20 states were analyzed for 15N abundance. Soil characteristics and environmental conditions at the sampling sites varied widely. The total N of surface soil samples had a mean delta 15N value (per mill 15N excess) slightly but significantly higher than the mean value for soils collected from deeper layers, although the relationship between delta 15N and soil depth was not consistent from location to location. Differences among mean delta 15N values for the total N of soil samples collected from cropland, pasture, uncultivated land (with native herbs), and forest were not striking. There was no systematic effect of variation in the rate of application of N fertilizer on the delta 15N of the total N of soils. The mean delta 15N value of surface soils, with respect to atmospheric N, was +9.22 and the standard deviation was 2.10 delta 15N units. The range within which 90% of the samples fell was +5.1 to +12.3 delta 15N units. Less than half of the variation among the soils in delta 15N of the total N could be accounted for by differences in environmental variables or soil characteristics. (Skogerboe-Colorado State)
W79-07494

NITROGEN MINERALIZATION AND DENITRIFICATION IN ORGANIC SOILS,
Cornell Univ., Ithaca, NY. Dept. of Soil Organic Chemistry.
T. F. Guthrie, and J. M. Duxbury.
Soil Science Society of America Journal, Vol. 42, No. 6, p 908-912, November-December, 1978. 1 fig, 6 tab, 13 ref.

Descriptors: *Nitrogen, *Denitrification, *Organic soils, Nitrates, Leachate, Laboratory tests.

The quantities of N mineralized when columns of Histosols were incubated at field capacity for periods up to 28 days corresponded to 500-600 kg N/ha per year without correction for N lost by denitrification. An absorption train utilizing molecular sieve 5A to collect N20 was used in denitrification experiments. Under an argon stream, 52-53% of the added NO3(-)-N was recovered as N2O, whereas the maximum concentration of N2O accumulating in the headspace of closed vessels amounted to 65% of the added NO3(-)-N. The quantity of N2O either collected or accumulating in a headspace was reduced to 15-41% of the NO3(-)-N denitrified when a second addition of NO3(-) was made to the soils. Denitrification occurred in both drained and flooded soil columns amended with NO3(-). The N2O recovered ranged from 2.5-9% and 9-19% of the NO3(-)-N denitrified in the drained and flooded columns, respectively. From 78-98% of the N2O was recovered in leachate from the flooded columns and the corresponding range for the drained columns was 11-52%. (Skogerboe-Colorado State)
W79-07495

NITRATE REDUCTION TO AMMONIUM IN ANAEROBIC SOIL,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. J. Buresh, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 6, p 913-918, November-December, 1978. 3 fig, 3 tab, 32 ref.

Descriptors: *Nitrates, Reduction(Chemical), Anaerobic conditions, *Denitrification, Nitrogen, Oxidation-reduction potential, *Soil chemistry.

The objectives were: (1) to compare the influence of various C substrates upon the extent of NO3(-) reduction to NH4(+) relative to denitrification in anaerobic soil, and (2) to determine the significance of NO3(-) conversion to NH4(+) and organic N in unamended anaerobic soil. Ammonium accumulates by way of mineralization under anaerobic conditions, consequently 15N-labelled NO3(-) was employed to distinguish between soil and NO3(-)-derived NH4(+). It was concluded that transformation of significant amounts of NO3(-) to NH4(+) and organic N required intensely reduced soil conditions. The reaction was apparently not suppressed by NH4(+). Evidence indicated that NO3(-) was reduced to NH4(+) by a nonassimilatory pathway in which NO3(-) functioned as a terminal electron acceptor. (Skogerboe-Colorado State)
W79-07496

SURFACE CHARGE MANIPULATION IN CONSTANT SURFACE POTENTIAL SOIL COLLOIDS: II. EFFECT ON SOLUTE TRANSPORT,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. S. Wann, and G. Uehara.
Soil Science Society of America Journal, Vol. 42, No. 6, p 886-888, November-December, 1978. 6 fig, 2 tab, 6 ref.

Descriptors: *Ion transport, Ion exchange, Colloids, Nutrient removal, Potassium, Phosphorus, Isotherms, *Solutes.

Potassium breakthrough curves from soil columns containing samples collected from an oxic horizon of a Typic Torrox shifted to the right as the sample was treated with increasing levels of P. The shift in the breakthrough curve was significantly related to

a lowering of the zero point of charge. The lowering of the zero point of charge was in turn related to levels of applied P. The anion accompanying K also had a marked effect on the position of the breakthrough curve. When the accompanying anion was Cl, S, and P respectively, the K concentration in the effluent attained one-half of influent concentration at 4.25, 5.30, and 8.20 pore volumes. (See also W79-04203) (Skogerboe-Colorado State)
W79-07499

2L. Estuaries

DETERMINATION OF SULFATE IN SEAWATER AND NATURAL BRINES BY 133BA AND MEMBRANE DIALYSIS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 1A.
W79-07056

A WATER POLLUTION PREDICTION SYSTEM BY THE FINITE ELEMENT METHOD,
IBM Japan Ltd., Osaka.
Y. Matsuda.
Advances in Water Resources, Vol. 2, No. 1, p 27-34, March 1979. 9 fig, 4 tab, 12 ref.

Descriptors: *Currents(Water), *Tidal waters, *Model studies, Mathematical models, Numerical analysis, Computer models, Finite element analysis, Tides, Flow, Velocity, Bays, Estuaries, Foreign countries, Foreign research, *Japan, *Osaka Bay(Japan), *Seto Inland Sea(Japan).

A water pollution prediction system using the finite element method was developed at the request of the Transportation Ministry of Japan which controls the national waters and harbors. As a practical numerical method, considering the accuracy and the computing time of a computer, an explicit finite element method and the steady dispersion method were used. This system was used to simulate the distribution of pollutants in Osaka Bay and the Seto Inland Sea, and its effectiveness was confirmed by objective data. (Sims-ISWS)
W79-07111

ACOUSTICAL ESTIMATION OF ZOOPLANKTON POPULATIONS,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 2H.
W79-07120

SALINITY INTRUSION AND GRAVITATIONAL CIRCULATION IN PARTIALLY STRATIFIED ESTUARIES,
California Univ., Berkeley.
J. M. Hamrick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 643, Price codes: A21 in paper copy, A01 in microfiche. Dissertation, PhD in Engineering, May 1979, 451 p, 91 fig, 26 tab, 3 append. (California Water Resources Center Project UCAL-WRC-W-486).

Descriptors: *Mathematical models, *Model studies, *Finite element analysis, *Saline water intrusion, *Saline water-freshwater interfaces, *Estuaries.

Mathematical and physical modeling techniques are used to study the dynamics of salinity intrusion in partially stratified estuaries when the residual gravitational circulation is the primary mechanism for longitudinal dispersion and salt transport. Emphasis is placed on quantifying the effect of transverse variations in channel depth on the three dimensional circulation patterns and the coupled salinity distribution. Solutions are obtained using perturbation and finite element methods for the three dimensional residual gravitational circulation velocity and salinity distributions in estuaries of constant nonrectangular prismatic cross section. The resulting longitudinal dispersion coefficients representing salt transport by the residual gravitational circulation are computed and used to develop an one dimensional salt transport equation. The theoretical and experimental results indicate that transverse variations in channel depth have a significant effect upon the circulation patterns and salinity distributions in partially stratified estuaries; and that the results of theories developed for rectangular cross section channels and laboratory studies conducted in rectangular cross section channels cannot in general be extrapolated to real estuaries. (Snyder-Calif.)
W79-07131

SUBTIDAL SEA LEVEL VARIATIONS IN THE CHESAPEAKE BAY AND RELATIONS TO ATMOSPHERIC FORCING,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
D-P. Wang.
Journal of Physical Oceanography, Vol. 9, No. 2, p 413-421, March 1979. 14 fig, 15 ref. NSF OCE74-08463, OCE77-20254.

Descriptors: *Chesapeake Bay, *Sea level, *Variability, Winds, Storms, Wind tides, Weather, Storm surge, Water levels, Measurement, Data processing, Time series analysis, Water circulation, Bays, Coasts, Estuaries, Oceanography, Subtidal sea level variations, Atmospheric forcing.

Subtidal sea level variations in the Chesapeake Bay were examined over a one-year period for evidence of wind-driven barotropic circulation. The major transport occurred at time scales of 3-5 days, whose magnitude was larger than the river runoff. It was driven by the east-west wind, as part of the coupled coastal ocean-estuary response. At shorter time scales, there was also large barotropic motion which, however, was driven by the local, north-south wind. The variance of barotropic fluctuation was larger by a factor of 4 in winter than in summer, due to the increased cyclone activities. The coupled coastal ocean-estuary response was also more pronounced in winter. In contrast, the summer season was dominated by local forcing at time scales of 3-7 days. The results suggested that the barotropic motion is an important component of the net circulation. The corresponding subtidal sea level change contributes significantly to the storm surge. Thus, the nature of barotropic response, particularly the coupled response, must be examined carefully for better understanding of the dispersion processes and storm surges in Chesapeake Bay. (Sims-ISWS)
W79-07139

OBSERVATIONS ON THE GEOCHEMISTRY OF SOLUBLE COPPER, IRON, NICKEL, AND ZINC IN THE SAN FRANCISCO BAY ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5A.
W79-07144

THE DENSITY AND SPEED OF SOUND OF ORCA BASIN WATERS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
For primary bibliographic entry see Field 1A.
W79-07145

ISOTOPIC ABUNDANCES OF LEAD IN ESTUARINE SEDIMENTS, SWANSEA BAY, BRISTOL CHANNEL,
Institute for Marine Environmental Research, Plymouth (England).
E. I. Hamilton, and R. J. Clifton.
Estuarine and Coastal Marine Science, Vol. 8, No. 3, p 271-278, March 1979. 3 fig, 1 tab, 15 ref.

Descriptors: *Lead, *Estuaries, *Isotope studies, *Sediments, Radioactivity, Dating, Radioactive dating, Heavy metals, Pollutants, Data collections, Sedimentation, On-site investigations, Foreign research, *United Kingdom, *Bristol channel(UK), Geochronology.

A historical record for the deposition of lead in Swansea Bay, Bristol Channel, United Kingdom, has been determined together with isotopic compositions. Analysis of the isotopic composition of lead in cores, dated by 210Pb-210Po chronology, illustrated a post 1850 influx of lead originating from technically produced materials. Since 1850 there has been a three-fold increase of lead in sediments of which only 25-30% can be accounted for from technical sources; the remainder is presumed to be derived from working of the South Wales Coal Measures. (Humphreys-ISWS)
W79-07148

LEAD-210 CHRONOLOGY IN RELATION TO LEVELS OF ELEMENTS IN DATED SEDIMENT CORE PROFILES,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Clifton, and E. I. Hamilton.
Estuarine and Coastal Marine Science, Vol. 8, No. 3, p 259-269, March 1979. 7 fig, 1 tab, 11 ref.

Descriptors: *Estuaries, *Lead, *Sediments, *Radioactivity, On-site investigations, Heavy metals, Zinc, Copper, Cores, Dating, Sedimentation rates, Foreign research, Sampling, Testing, *United Kingdom, *Severn Estuary(UK), *Tamar Estuary(UK), Geochronology.

This paper described the use of 210Pb-210Po chronology to determine sedimentation rates in the Severn (Swansea Bay, Bridgwater Bay, Newport Deep) and Tamar estuaries of the United Kingdom. Samples taken from Swansea Bay and the Tamar showed a significant decrease in the specific radioactivity of 210Pb with depth, while samples from Newport Deep and Bridgwater Bay did not show this feature--instead the 210Pb activity tended to be constant. Attempts were made to confirm the derived sedimentation rates using other data such as lead isotopic compositions and the industrial history of the areas. These attempts were partially successful, but there is still a need for an unequivocal means of confirmation. (Humphreys-ISWS)
W79-07149

ORGANIC CARBON ISOTOPE RATIOS IN RECENT SEDIMENTS IN THE ST. LAWRENCE ESTUARY AND THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
F. C. Tan, and P. M. Strain.
Estuarine and Coastal Marine Science, Vol. 8, No. 3, p 213-225, March 1979. 5 fig, 4 tab, 29 ref.

Descriptors: *Organic matter, *On-site investigations, *Estuaries, *Canada, Carbon, Radioisotopes, Sediments, Analysis, On-site data collections, Isotope studies, Analytical techniques, Statistical methods, Sampling, Testing, Methodology, *Gulf of St Lawrence, *St Lawrence Estuary, Organic carbon.

The distribution of 13C in the organic fraction of surface sediments was determined in order to examine the relative contributions of terrestrial and marine organic carbon to sediments in the St. Lawrence Estuary, Saguenay Fjord, and the Gulf of St. Lawrence, Canada. The delta 13C results showed that the organic matter deposited within the Saguenay Fjord (-25.9 + or - 0.4 parts per thousand) and the upper St. Lawrence Estuary (-25.0 + or - 0.6 parts per thousand) is of terrestrial origin. The variability of delta 13C values observed in sediments from the lower St. Lawrence Estuary (-25.6 to -21.8 parts per thousand) suggests the presence of organic matter from both terrestrial and marine sources. Remarkably uniform values were observed in the open Gulf of St. Lawrence (-22.4 + or - 0.2 parts per thousand). On the basis of delta 13C studies, it was concluded that terrestrial organic matter from the St. Lawrence drainage basin is deposited within the lower St. Lawrence Estuary and that the organic matter in the open Gulf of St. Lawrence is of local or other marine origin. The use of carbon isotope ratios to delineate the extent of terrestrial organic carbon in

sediments was briefly compared with the use of C/N ratios and lignin concentrations. The delta 13C values from the study area fall within the range observed by other workers from other areas. (Humphreys-ISWS)
W79-07150

ADDRESS OF THE RETIRING PRESIDENT OF THE INTERNATIONAL ASSOCIATION OF SEDIMENTOLOGISTS: DIFFERENCES IN SIZE DISTRIBUTIONS OF POPULATIONS OF PARTICLES AMONG SANDS OF VARIOUS ORIGINS,
Rensselaer Polytechnic Inst. Troy, NY. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W79-07152

DIFFRACTION OF WATER WAVES BY ISOLATED STRUCTURES,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
V. W. Harms.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW2, Proceedings Paper 14561, p 131-147, May 1979. 12 fig, 28 ref, 2 append.

Descriptors: *Waves(Water), *Ocean waves, *Offshore platforms, *Model studies, Mathematical models, Laboratory tests, Hydraulic models, Structures, Shore protection, Islands, Coasts, Beaches, Oceans, Hydrodynamics, Coastal engineering, Artificial islands, Wave diffraction.

A diffraction theory based upon the method of Green functions was presented and compared to existing exact solutions and an approximate one. The solution was obtained by approximating an integral equation for the wave potential by a set of linear equations. Wave-height distributions were analyzed in order to determine the affect of structure geometry upon the diffraction process. The wave-height topography in the wave-lee of four separate, geometrically-different cylinders (of the same size) was calculated and compared to laboratory measurements. The distance was established beyond which the wave-height topography is independent of the geometrical features of the wave-diffracting obstacle. Laboratory measurements were performed in the wave-lee region from 1/2 to 20 wavelengths from the structure. At large distances from the structure, experimental wave heights were significantly greater than indicated by theory. (Sims-ISWS)
W79-07162

NONLINEAR MODELING OF WAVE RUNUP ON SLOPING BEACH,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. N. Sharma.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW2, Proceedings Paper 14564, p 125-129, May 1979. 2 fig, 3 ref, 2 append.

Descriptors: *Waves(Water), *Ocean waves, *Beaches, *Model studies, Mathematical models, Correlation analysis, Probability, Equations, Wave runup, Autocorrelation, Spectral analysis, Nonlinear systems.

A new method of identifying nonlinear systems has been developed and applied to the wave runup process. The new method consists of estimating the parameters of the nonlinear system through the known relation between the correlation functions of the input and output records. The unknown function representing the nonlinear system is expanded into a series of Hermite polynomials. The output autocovariances are expressed in terms of the input autocorrelations and the unknown system function. This provides as many equations as there are autocovariance estimates. From these equations, the parameters of the function representing the nonlinear system were estimated. The autocorrelations and spectral density were computed by using the nonlinear model and compared with the actual autocorrelation and spectral density of the measured output. The predictions are reasonably close to the observations. Results presented indicate the possibility of representing the surf zone as a nonlinear system. (Sims-ISWS)
W79-07163

JOINT OCCURRENCES IN COASTAL FLOODING,
North Carolina State Univ. at Raleigh. Dept. of Marine Science and Engineering.
M. A. Tayfun.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW2, Proceedings Paper 14560, p 107-123, May 1979. 10 fig, 8 ref, 2 append.

Descriptors: *Coastal plains, *Flooding, *Probability, Floods, Coasts, Hurricanes, Tides, Storm surge, Tsunamis, Flood waves, Winds, Design flood, Mathematical models, Statistics, Statistical models, Statistical methods, Analytical techniques.

Extreme levels of coastal flooding arising from the joint occurrence of a rare event, such as a hurricane or a tsunami with the astronomical tide, have a stochastic nature resulting from the random occurrence of the primary event relative to the phase of the astronomical tide. Numerical means of computing the frequencies of peak flood levels by constructing equally likely combinations of tides with the record of a rare event are costly and impractical to apply. This paper presented an approximate analytic approach to construct the probability structure of extremal crest heights arising from such joint occurrences based on simple astronomical tide models. Examples were given to illustrate application to tsunamis and storm surges. (Sims-ISWS)
W79-07164

THE ZOOPLANKTON OF MGAZANA, A MANGROVE ESTUARY IN TRANSKEI, SOUTHERN AFRICA,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
T. Wooldridge.
Zoologica Africana, Vol. 12, No. 2, p 307-322, 1977. 3 fig, 6 tab, 8 ref.

Descriptors: *Estuaries, *Mgazana(Transkei South Africa), *Zooplankton, *Copepods, Plankton, Aquatic animals, Invertebrates, Biomass, Aquatic habitats, Sampling, Estuarine environment, Nets, Plankton nets, Equipment.

Zooplankton samples were taken at 11 stations at six-week intervals from May 1972 to March 1973 at Mgazana, a mangrove estuary in Transkei. In the middle and lower estuary salinities were consistently above 25 parts/thousand; salinity in the upper estuary varied between 4 and 29 parts/thousand. Water temperatures varied from 15.5C to 28C. During the sampling 115 taxa of zooplankton organisms were recorded. The zooplankton in the mouth of the estuary was very diversified. Population densities for the copepods, Acartia natalensis and Oithona brevicornis, of over 100,000/m3 of water were recorded. The total zooplankton biomass, relatively low in winter, increased markedly from October. The maximum biomass of 1,200 mg/m3 recorded in February in the middle estuary was attributed to the mysid Mesopodopsis africana. Mysids, major contributors to the biomass, showed definite seasonal and spatial distribution patterns in the estuary. (Davison-IPA)
W79-07180

HYDROGRAPHIC PROJECT,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 2A.
W79-07289

FORCES ON BLOCK BODIES ACCELERATING IN STILL FLUID,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
D. G. Goring, and F. Raichlen.
Journal of the Waterway, Port, Coastal and Ocean Division, Vol. 105, No. WW2, Proceedings Paper 14582, p 171-189, May 1979. 15 fig, 2 tab, 13 ref, 1 append.

Descriptors: *Drag, *Loads(Forces), *Anchors, Waves(Water), Ocean waves, Offshore platforms, Energy, Hydrodynamics, Hydraulic models, Laboratory tests, Analytical techniques, Hydraulic models, Laboratory tests, Analytical techniques, Oceanography, Engineering, Acceleration, Intertia.

Experimental results for the drag coefficient and the added hydrodynamic mass coefficient for block bodies, plates, and models of deadweight anchors were presented. A unique method was examined for eliminating noise from an analog signal that relates to the analysis of the recorded forces and for determining the drag and inertia coefficients in the frequency domain. Results from a regression analysis to determine the drag coefficients and hydrodynamic mass coefficients were presented and compared to the other method employed. The experiments showed that both the added mass and the drag coefficients are dependent upon the ratio of the amplitude of the water particle excursion to the major dimension of the body. (Sims-ISWS)
W79-07315

DESIGN CRITERIA FOR FLOATING TIRE BREAKWATERS,
State Univ. of New York at Buffalo.
V. W. Harms.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 105, No. WW2, Proceedings Paper 14570, p 149-170, May 1979. 23 fig, 13 ref, 1 append.

Descriptors: *Breakwaters, *Coastal engineering, *Waves(Water), Shore protection, Marinas, Ocean waves, Coasts, Barriers, Floating, Loads(Forces), Engineering, Floating breakwaters, Tire breakwaters, Tires, Floating bodies.

Wave-transmission and peak-mooring force design curves were generated for the Goodyear and Wave-Guard floating tire breakwaters from measurements on 1/8-scale and 1/4-scale models using regular and irregular waves and were found to be in good agreement with available full-scale data. These curves may be used to determine the breakwater size needed to attenuate a given regular design wave to an acceptable level, and also to determine the maximum mooring load associated with this. A simple semi-empirical energy-dissipation model was developed and found to simulate measured wave-transmission characteristics with sufficient precision to be useful in many engineering applications; e.g., the ratio of transmitted to incident wave height is stated as an exponential function of wave steepness, ratio of wavelength to breakwater-beam-size, breakwater porosity, and a drag coefficient. An empirical relationship for the peak mooring force was obtained. (Sims-ISWS)
W79-07316

COMBINED WAVE AND CURRENT INTERACTION WITH A ROUGH BOTTOM,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
W. D. Grant, and O. S. Madsen.
Journal of Geophysical Research, Vol. 84, No. C4, p 1797-1808, April 20, 1979. 4 fig, 3 tab, 24 ref. NOAA/AOML 03-6-022-35220.

Descriptors: *Waves(Water), *Mathematical models, *Theoretical analysis, *Boundaries(Surfaces), Model studies, Analytical techniques, Coasts, Currents(Water), Shear stress, Fluid friction, Roughness(Hydraulic), Flow resistance, Surfaces, Sediment transport, Water circulation.

An analytical theory was presented to describe the combined motion of waves and currents in the vicinity of a rough bottom and the associated boundary shear stress. Characteristic shear velocities were defined for the respective wave and

current boundary layer regions by using a combined wave-current friction factor, and turbulent closure was accomplished by employing a time invariant turbulent eddy viscosity model which increases linearly with height above the seabed. The resulting linearized governing equations were solved for the wave and current kinematics both inside and outside the wave boundary layer region. For the current velocity profile above the wave boundary layer, the concept of an apparent bottom roughness was introduced, which depends on the physical bottom roughness as well as the wave characteristics. The net result is that the current above the wave boundary layer feels a larger resistance due to the presence of the wave. The wave-current friction factor and the apparent roughness are found as a function of the velocity of the current relative to the wave orbital velocity, the relative bottom roughness, and the angle between the currents and the waves. In the limiting case of a pure wave motion, the predictions of the velocity profile and wave friction factor from the theory were shown to give good agreement with experimental results. The reasonable nature of the concept of the apparent bottom roughness was demonstrated by comparison with field observations of very large bottom roughnesses by previous investigators. The implications of the behavior predicted by the model on sediment transport and shelf circulation models were discussed. (Humphreys-ISWS)
W79-07328

POLLUTION HISTORY OF THE SAVANNAH RIVER ESTUARY,
Scripps Institution of Oceanography, La Jolla, CA.
E. D. Goldberg, J. J. Griffin, V. Hodge, M. Koide, and H. Windom.
Environmental Science and Technology, Vol. 13, No. 5, p 588-594, May 1979. 4 fig, 4 tab, 16 ref. NRC AT(49-24)-036.

Descriptors: *Estuaries, *Pollutants, *Metals, *Georgia, *History, Data collections, On-site investigations, Sediments, Salt marshes, Plutonium, Radioisotopes, Sampling, Evaluations, Cores, Analysis, Cesium, Lead, Zinc, Chromium, Copper, Cobalt, Nickel, Manganese, Aluminum, Iron, Vanadium, Effects, *Savannah River(GA), Geochronology.

Records of natural and pollutant fluxes to the Savannah River estuarine system are found in some river and marsh deposits into which time frames can be introduced by 210Pb or plutonium geochronologies. Plutonium releases from the Savannah River Plant to the environment are evident in only one deposit and in marsh grass, both of which have elevated levels of the 238Pu/(239 + 240)Pu ratios in comparison to those expected from atmospheric fallout. The highest concentrations of metals were found in deposits upriver; in sediments of the estuary itself, lower concentrations of the metals resulted from their dilution through the entry of oceanic solid phases. The impact of man upon the composition of Savannah River is recorded in its deposits. Increased levels of lead, chromium, and vanadium, well-recognized pollutants, in the recently deposited strata provide the evidence for this argument. (Humphreys-ISWS)
W79-07330

SOURCES AND MOVEMENT OF ORGANIC CHEMICALS IN THE DELAWARE RIVER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W79-07331

ENVIRONMENTAL POLY(ORGANOSILOXANES) (SILICONES),
Naval Research Lab., Washington, DC. Ocean Sciences Div.
R. Pellenbarg.
Environmental Science and Technology, Vol. 13, No. 5, p 565-569, May 1979. 2 fig, 3 tab, 23 ref. NSF-OCE-77-2079.

Descriptors: *Pollutants, *Polymers, *Estuaries, *Potomac River, *Chesapeake Bay, *Delaware, *New Jersey, Sediments, Cores, Sampling, Analysis, Evaluation, Bays, Analytical techniques, Testing, Methodology, *Delaware Bay, Silicones.

Poly(organosiloxanes) (silicones), which are totally synthetic polymers, were measured in the sediments of the Potomac River, Washington, D.C., and Delaware Bay, Delaware-New Jersey. The Potomac sediments exhibited an average of 1.38 ppm (range 0.46-3.07 ppm) of extractable silicone. The Bay sediments showed an average of 0.61 ppm (range 0.10-1.56 ppm) of extractable silicone. Data from both locations are based on a 35% recovery efficiency for the solvent extraction technique using diethyl ether to recover silicones from dried solids. Extracts, converted to methyl isobutyl ketone solution, were analyzed by nitrous oxide-acetylene flame atomic absorption spectrophotometry. Furthermore, the aqueous surface microlayer in a boat harbor on the Chesapeake Bay contained an average of 30 ppb of silicone, and microlayer from Delaware Bay contained an average of 34 ppb of silicone. All data are on a weight/weight basis, and are reported as organic silicon. Due to the ubiquitous occurrence of silicones seen in this study, silicones are offered as excellent tracers for anthropogenic additions to the environment. (Humphreys-ISWS)
W79-07333

OBSERVATIONAL EVIDENCE FOR VERTICAL DIFFUSION DRIVEN BY INTERNAL WAVES OF TIDAL ORIGIN IN THE OSLOFJORD,
Goteborg Univ. (Sweden). Dept. of Oceanography.
A. Stigebrandt.
Journal of Physical Oceanography, Vol. 9, No. 2, p 435-441, March 1979. 3 fig, 4 tab, 9 ref.

Descriptors: *Fjords, *Internal waves, *Model studies, *On-site investigations, Sampling, Water circulation, Tidal waters, Currents(Water), Temperature, Water temperature, Density, Mathematical models, Estuaries, Coasts, *Norway, *Oslofjord(Norway).

In an earlier paper, a model was proposed for internal wave-induced vertical mixing in a sill fjord. The observational evidence for the theory at that time was rather sparse, but the void was materially filled by observations presented in this note. Current measurements showed, in accordance with the theory, that progressive internal waves radiate out from the Drobak sill in the Oslofjord. An experiment with tracer dye below the sill depth in the same fjord showed that the coefficient of vertical diffusion of the tracer was an order of magnitude less than the overall coefficient for vertical diffusion of density during the same period. This finding, indicating large horizontal inhomogeneities in the mixing field, gives strong support to the mixing model proposed in the earlier paper. (Sims-ISWS)
W79-07335

AN ECOPHYSIOLOGICAL STUDY OF THE MEIOFAUNA OF THE SWARTKOPS ESTUARY. 1. THE SAMPLING SITES: PHYSICAL AND CHEMICAL FEATURES,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
A. H. Dye.
Zoologica Africana, Vol. 13, No. 1, p 1-18, 1978. 9 fig, 3 tab, 22 ref.

Descriptors: *Estuaries, *Swartkop estuary(South Africa), *Physical properties, *Chemical properties, *Sampling, *Estuarine environment, Aquatic animals, Invertebrates, Porosity, Permeability, Temperature, Nitrogen, Oxygen, Salinity, Chlorophyll, Particle size, Tidal waters, Tidal effects.

Chemical and physical features of the two beaches in the Swartkops estuary were monitored at monthly intervals over a 14-month period for temperature, nitrogen, chlorophyll a, oxygen, and salinity. Measurements were made of sand particle size, porosity, permeability, and desiccation. The environmental conditions were most severe at the higher tidal levels and in the upper reaches of the estuary. Nitrogen and chlorophyll a varied greatly from month to month; salinity and temperature were highest in the summer and lowest in winter, or during floods; oxygen tensions were highest in winter and lowest in summer, except where desiccation occurred and air replaced water in the substrate. The presence of sand prawns, Callianassa kraussi, influenced the oxygenation and water circulation of the deeper sediments adjacent to their burrows. It is suggested that macrofaunal organisms with burrows extending from the surface have similar effects. (See also W79-07349) (Davison-IPA)
W79-07348

AN ECOPHYSIOLOGICAL STUDY OF THE MEIOFAUNA OF THE SWARTKOPS ESTUARY. 2. THE MEIOFAUNA: COMPOSITION, DISTRIBUTION, SEASONAL FLUCTUATION AND BIOMASS,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
A. H. Dye, and J. P. Furstenberg.
Zoologica Africana, Vol. 13, No. 1, p 19-32, 1978. 3 fig, 5 tab, 28 ref.

Descriptors: *Estuaries, *Swartkop estuary(South Africa), *Aquatic animals, *Biomass, *Distribution patterns, Fluctuations, Aquatic populations, Invertebrates, Seasonal, Biorhythms, Temperature, Oxygen, Nitrogen, Chlorophyll, Nematodes, Aquatic microorganisms, Particle size, Intertidal areas.

Analyses of faunal samples collected from two stations in the Swartkops estuary in South Africa showed population densities in a direct relationship with particle size. Although oxygen appeared to be the controlling factor, desiccation greatly influenced the intertidal distribution of meiofauna in sandy areas. Variations of temperature and oxygen were found to be responsible for the seasonal fluctuations in numbers which peaked during spring and autumn. The vertical penetration and seasonal fluctuation of the meiofauna were affected by the presence of the sand prawn, Callianassa kraussi. Because fluctuations in nitrogen and chlorophyll a had little relationship to the fluctuation of the meiofauna, it is concluded that food is not limiting in these areas. Nematodes, the dominant biomass taxon, weighed 0.42 micrograms, ash-free dry mass. The standing crop biomass determined to a depth of 20 cm was 0.40 g/sq m for sandy areas, and 0.07 g/sq m in the muddy areas. (See also W79-07348) (Davison-IPA)
W79-07349

MAINTENANCE OF THE NON-BREEDING POPULATIONS OF THE ESTUARINE PRAWN CALLIANASSA KRAUSSI (CRUSTACEA, ANOMURA, THALASSINIDEA),
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology.
A. T. Forbes.
Zoologica Africana, Vol. 13, No. 1, p 33-40, 1978. 5 fig, 9 ref.

Descriptors: *Estuarine environment, *Aquatic animals, *Crustaceans, Animal populations, Life cycles, Migration, Salinity, Saline water, Resistance, Reproduction, Animal behavior, Breeding.

Callianassa kraussi Stebbing eggs were hatched in the laboratory in water with variations in salinity ranging from 5 to 35 parts/thousand to determine salinity tolerances. No eggs hatched and no first stage larvae survived in salinities below 20 parts/thousand; hatch percentage increased steadily with increasing salinity up to 35 parts/thousand. Second stage larvae were more tolerant of low salinities than first stage larvae. Of the second stage larvae in a salinity of 15 parts/thousand 80% successfully moulted to the next stage. The results of these experiments indicate that populations living in areas where salinity is permanently less than 17 parts/thousand are not self-maintaining and migrate from higher salinity areas during early post

larval stages. The species studied appears to be the only one in the genus capable of existing permanently in reduced salinities as evidenced by its presence in the Keurbooms River estuary at a salinity of 1 part/thousand. (Davison-IPA)
W79-07350

EPIBENTHIC ALGAL PRODUCTION IN THE SWARTKOPS ESTUARY,
Port Elizabeth Univ., (South Africa). Dept. of Zoology.
A. H. Dye.
Zoologica Africana, Vol. 13, No. 1, p 157-158, 1978. 1 tab, 7 ref.

Descriptors: *Estuaries, *Primary productivity, *Estuarine environment, *Swartkops estuary(South Africa), *Benthos, Tidal effects, Water level fluctuations, Turbidity, Seasonal, Oxygen demand, Productivity.

Benthic metabolism was measured during the spring and autumn at a sandy beach near the mouth of the Swartkops estuary (station A) and a muddy beach in the upper reaches (station B). Four tidal levels were studied at each station: high water (HW), mid water (MW), low water (LW), and under water (UW). The under water level was permanently covered by water to at least 0.30 m. Results of primary production determinations are tabulated. For station A the mean spring production was 58.5 g C/sq m/y, autumn production was 47.0 g C/sq m/y. At station B spring production averaged 123.0 g C/sq m/y, autumn production was 109.5 g C/sq m/y. The annual mean production was 53 g C/sq m/y for sandy areas and 116.5 g C/sq m/y for muddy areas. Primary production increased from HW to UW in sandy areas. The primary highest production for muddy areas occurred at LW with a large decrease towards UW because of turbidity. (Davison-IPA)
W79-07351

ECOLOGY OF THE AGULHAS CURRENT REGION: AN ASSESSMENT OF BIOLOGICAL RESPONSES TO ENVIRONMENTAL PARAMETERS IN THE SOUTH-WEST INDIAN OCEAN,
Natal Univ., Durban (South Africa) Oceanographic Research Inst.
A. E. F. Heydorn, N. D. Bang, A. F. Pearce, B. W. Flemming, and R. A. Carter.
Transactions of the Royal Society of South Africa, Vol. 43, Part 2, p 151-190, May 1978. 11 fig, 92 ref.

Descriptors: *Ecology, *Ecosystems, *Ocean currents, *Agulhas Current, *Indian Ocean, Sharks, Ocean circulation, Sediment transport, Sediment-water interfaces, Estuaries, Teleosts, Continental shelf, Topography, Ecological distribution, Natal.

Multi-disciplinary oceanographic research was carried out in the waters of the east coast of South Africa with emphasis on Natal. Natal coastal waters are characterized by the Agulhas Current, a very narrow continental shelf, the entry of many rivers into the sea, a series of large-scale surface water circulation patterns, and a large number of estuarine systems. The distribution and transport of sediments, basic to the occurrence of benthic fauna and ecological patterns, is closely related to the interrelationship between bottom topography and circulation patterns. Temperature induced responses, utilization of current transport mechanisms, and larval retention mechanisms and marine/estuarine interaction are given for calanoid Copepoda, Chaetognatha, spiney lobsters, marine turtles, sharks, estuarine fishes, and teleost fishes. The responses and adaptations of the animals studied provide insight into the ecological mechanisms operating in this region. It is concluded that the high flow velocities of the Agulhas Current are responsible for the massive sediment transport and distribution among the Natal coastal waters. (Davison-IPA)
W79-07355

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENTAL TESTING OF A SECONDARY REFRIGERANT FREEZING DESALINATION PILOT PLANT AT THE WRIGHTSVILLE BEACH TEST FACILITY,
Office of Water Research and Technology, Wrightsville Beach, NC.
R. S. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 811, Price codes: A06 in paper copy, A01 in microfiche. Final Report (1979), 101 p, 15 fig, 1 tab.

Descriptors: *Desalination, *Freezing process, Secondary refrigerant method, Pilot plant, Operations.

Operational testing, maintenance and modification were conducted for nine months on a 75,000 gallon per day desalination plant. The operational parameters of a 13 foot in diameter counterwash column for this process were evaluated. Changes were made to various parts of the pilot plant to improve operations. Design deficiencies in the process and the pilot plant equipment were identified and recommendations were made to alleviate the problems. Material analysis of various aluminum components in the plant was made by Argonne National Laboratory and the results are included in this report.
W79-07255

DESALINATION OF SALT WATER BY SOLAR ENERGY MEANS,
FIAT S. p. A., Turin (Italy). (Assignee).
A. La Rocca.
U.S. Patent No. 4,135,985, 8 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1377, January 23, 1979.

Descriptors: *Patents, *Desalination, *Desalination processes, *Desalination apparatus, Water treatment, Water quality, Condensation, Separation techniques, Evaporation, Solar radiation, Solar distillation.

A desalination system is provided which has no moving parts, in which the heat given up on condensation of the water vapor is used for preheating the incoming salt water; and in which the intake of salt water to be desalinated is controlled by a static automatic control system. The apparatus using solar energy comprises a main insulated container with a subsidiary preheating container next to it; the main container is covered with a transparent cover serving as a selective filter to provide 'the greenhouse effect' and also as a condensation surface for water vapor. This transparent cover incorporates a hollow space, for example by making the cover double skinned. The hollow space forms part of a syphon which automatically regulates the water levels, transferring salt water from a preheating container to the main container as the level in the main container falls due to loss by evaporation leading to condensation and withdrawal of the desalinated water. The hollow part of the transparent cover thus serves also to preheat the incoming salt water with the heat lost upon condensation by the vapor within the main container. (Sinha-OEIS)
W79-07400

EAST MESA GEOTHERMAL TEST SITE,
Bureau of Reclamation, Boulder City, NV. Div. of Planning.
W. A. Fernelius, and M. K. Fulcher.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EEI, p 13-32, February, 1979. 7 fig, 4 tab, 5 ref.

Descriptors: *Desalination processes, *Geothermal studies, *Desalination apparatus, Flash distillation, Electrodialysis, Evaporators, Corrosion, Scaling, Water quality, Heat transfer, Desalination plants, Design, Construction, Economic feasibility.

The results of a geothermal desalination program at East Mesa, Imperial Valley, California are described. The primary objective of this program is to provide the necessary information to permit design, construction, operation and maintenance of economical and efficient desalting systems using geothermal fluids. Three types of desalting units were tested: (1) a multistage flash (MSF) unit; a vertical tube evaporator (VTE) unit; and a high temperature electrodialysis (HTED) unit. Studies on corrosion, scale prevention, water quality, materials, and heat transfer were run concurrently with each test. All three desalting systems proved capable of desalting geothermal fluid. Problems associated with each are discussed along with possible solutions. Determination of the economic feasibility of geothermal desalting depends on other important factors such as productivity of the geothermal reservoir, compatibility of fluids, environmental concerns, and the source of replacement fluids. Data on these items are forthcoming and will provide the basis for the design and cost estimates for a production-size desalting plant. This study will include the feasibility of producing power concurrently with desalting. (Purdin-NWWA)
W79-07497

3B. Water Yield Improvement

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

FINAL ENVIRONMENTAL STATEMENT: PROJECT SKYWATER, A PROGRAM IN PRECIPITATION MANAGEMENT, VOLUME I.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 294, Price codes: A17 in paper copy, A01 in microfiche. Report No. INT FES 77-39-V-1, October 25, 1977. 363 p, 52 fig, 41 tab.

Descriptors: *Weather modification, *Cloud seeding, *Environmental effects, Cloud physics, Impact(Rainfall), Orography, Clouds, Planning, Precipitation(Atmospheric), Water, Artificial precipitation, Erosion, Runoff, Agriculture, Snow removal, Snowpacks, Ranges, Land management, Groundwater recharge, Rainfall, Rainfall-runoff relationships, Meteorology.

The programs, purpose, scope and environmental impacts of Project Skywater, a research program in cloud seeding for enhanced precipitation conducted by the Bureau of Reclamation, are presented in a final environmental statement. The research cloud seeding program is designed to remove scientific doubt and develop the required technology to make cloud seeding scientifically sound and socially acceptable as a water management tool. The research is not expected to have significantly adverse impacts, and any effect on avalanches and snow removal costs will most likely be undetectable. Application of this technology could increase high forest and alpine seasonal snowpacks up to about 15% and lengthen snow cover in areas prone to drifting by a week. Runoff in the high country would be increased about 20%, and local water quality should improve. The carrying capacity of elk ranges could be decreased in a few locations at an undetectable level. A possible 10% increase in summer convective rainfall would result in minor, local increases in humidity, runoff, and groundwater levels. Although erosion would most likely decrease on vegetated lands, range converted to cropland might become more subject to erosion. For each potential impact two numerical ratings are given: one applicable to the research program, the other applicable if the technology being devel-

oped is applied in a long-term, continuous, and widespread mode. (See W79-07490 and W79-07491) (Davison-IPA)
W79-07489

FINAL ENVIRONMENTAL STATEMENT: PROJECT SKYWATER, A PROGRAM IN PRECIPITATION MANAGEMENT, VOLUME II, APPENDICES A-J.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 295, Price codes: A10 in paper copy, A01 in microfiche. Report No. INT FES 77-39-V-2, 1977. 206 p, 25 fig, 68 tab, 292 ref.

Descriptors: *Weather modification, *Hydrologic cycle, *Cloud seeding, *Artificial precipitation, Chemistry of precipitation, Rainfall, Silver iodide, Meteorology, Environmental effects, Agriculture, Economics, Ecology, Bibliographies, Sierra Cooperative Project, High Plains.

The Final Environmental Statement for Project Skywater is contained in three volumes: the major report and two appendices. Volume II consists of the detailed studies behind the report. The hydrologic cycle, a group of processes operating along the paths through which water in nature circulates, is discussed. Seeding agents are listed and discussed with regard to their application and environmental impact. The planning concepts of the Sierra Cooperative Pilot Project are examined. This project involves deliberate weather modification to increase snow accumulation feeding streams originating in the Sierra Nevada, and has been suggested as a means of augmenting California's water supply. The High Plains are described in detail with reference to hydrometeorology, ecology, agriculture, and economics. A glossary and a bibliography containing 140 listings are provided. (See also W79-07489) (Davison-IPA)
W79-07490

FINAL ENVIRONMENTAL STATEMENT: PROJECT SKYWATER, A PROGRAM IN PRECIPITATION MANAGEMENT, VOLUME III, APPENDIX K.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 296, Price codes: A12 in paper copy, A01 in microfiche. Report No. INT FES 77-39-V-3, 1977. 262 p.

Descriptors: *Weather modification, *Environmental effects, *Water resources, *Planning, *Research and development, Information exchange, Documentation, Data collections, Legal review, Planning, Projects.

Copies of letters sent to Federal, State, and local agencies, other organizations, and individuals soliciting their review and comment on the Project Skywater Draft Environmental Statement and responses to these are presented. Official transcripts of public hearings are included. (See also W79-07489) (Davison-IPA)
W79-07491

3C. Use Of Water Of Impaired Quality

WASTE WATER REUSE IN PHOENIX--HOW VIABLE IS IT,
Stevens, Thompson and Runyan, Inc., Phoenix, AZ.
J. Fulton, and W. L. Chase.
Water Resources Bulletin, Vol. 15, No. 2, p 426-435, April 1979. 2 fig, 1 tab.

Descriptors: *Water reuse, *Planning, *Water resources, *Arizona, Groundwater, Groundwater recharge, Agriculture, Irrigation, Recreation, Recreation facilities, Lakes, Fish, Cooling water, Wildlife habitats, Waste water disposal, Waste water treatment, Water conservation, *Phoenix(AZ), *Salt River(AZ).

The Phoenix metropolitan area has a unique combination of circumstances which makes it one of the prime areas in the Nation for wastewater reuse. Overriding all of these conditions is the long-term inadequacy of the existing water supplies. The Salt River Valley has a groundwater overdraft of about 700,000 acre feet per year. To help alleviate this situation, the Corps of Engineers, in conjunction with the MAG 208, is looking at ways to reuse a projected year 2020 wastewater flow of 340,000 acre feet per year. Reuse options identified included groundwater recharge, agricultural irrigation, turf irrigation, recreational lakes, fish and wildlife habitats, and industrial cooling. These look nice on paper, but before they can be implemented, some hard questions have to be answered, such as: how acceptable are local treatment plants when 15 years ago there was a major push to eliminate local plants; is the Phoenix area ready for reuse in urban areas; what are people willing to pay for water; who benefits if a city goes to groundwater recharge; how much agriculture will be left in the area by 2020. These and other questions must be resolved is reuse is to become a viable option in water resource planning in the Phoenix area. (Sims-ISWS)
W79-07118

EVALUATION OF CHANGES IN THE NILE WATER COMPOSITION RESULTING FROM THE ASSWAN HIGH DAM,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
A. M. Balba.
Journal of Environmental Quality, Vol. 8, No. 2, p 153-156, April-June 1979. 4 tab, 9 ref.

Descriptors: *Rivers, *Water quality, *Nutrients, *Sediments, Salinity, Foreign research, Foreign countries, Irrigation, Suspended solids, Data collections, Potassium, Calcium, Magnesium, Nitrogen, *Egypt, *Nile River(Egypt), *Asswan High Dam, *Lake Nasser(Egypt).

The composition of Nile River water was examined to show the effect of the Asswan High Dam on the fertility and salinity of the water for irrigation. The Nile water contains about 110,000,000 metric tons/year of suspended materials as it crosses the Egyptian border. Before the Asswan High Dam was constructed, 24,000,000 metric tons/year of solids were deposited, mainly on the Egyptian floodplains. After the dam was finished, only 2,100,000 metric tons/year of solids were present in the Nile water to be deposited on the Egyptian soils; the remainder, 21,900,000 metric tons/year of solids, settled out in Lake Nasser. The loss of nutrients in the sediments which settled out in Lake Nasser and the gain in soluble cations which resulted from construction of the Dam were calculated from sediments and water analyses. The loss of 12,000 metric tons/year of sediment N is probably not significant for Egyptian agriculture. The loss of P, including a maximum of 6,000 metric tons/year of soluble P, will probably require a significant increase in the use of P fertilizers. The quality of the Nile water for irrigation, as determined by values for electrical conductivity, sodium adsorption ratio, adjusted sodium adsorption ratio, residual carbonate, and pHc, did not change significantly after construction of the dam. (Humphreys-ISWS)
W79-07160

METHANE FROM GEOPRESSURED AQUIFERS STUDIED,
University of Southern California, Los Angeles.
For primary bibliographic entry see Field 6B.
W79-07193

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: AN OVERVIEW (VOLUME 1),
Wisconsin Univ.-Madison. Law School.
For primary bibliographic entry see Field 6E.
W79-07232

UNDERGROUND REFRIGERATION PRACTICE: COMPARING THE WATER SOURCES,
J. Whillier.
S. A. Mining and Engineering Journal, Vol. 89, No. 4139, p 57 and 59, April 1978. 2 tab.

Descriptors: *Water quality, *Refrigeration, *Mining, *Cooling, *Temperature control, Condensers, Coolants, Cooling towers, Cooling water, Water types, Heat transfer, Cost analysis, Cost comparisons, Operating costs.

The quality of water from three sources for use in refrigeration systems in South African gold mines is discussed. The water sources considered are: Rand Water Board (RWB) or Irrigation Department, underground fissure water, and recirculated settled mine water. The suitability of the last two types must be determined by detailed chemical analysis. RWB water, the most suitable and most costly, is cooler than water from other sources, reflecting refrigeration cost savings that would offset the purchase cost. However, supplies cannot be guaranteed at all times. Fissure water, the most suitable alternative because it can be made potable, can be treated for closed circuit condenser cooling to reduce scale formation. Its disadvantage is that it enters the mine at a temperature close to that of the surrounding virgin rock and requires additional refrigeration. According to an analysis of fissure water from a number of various zones it was determined that water from level 50 was most suitable. Cost analyses of the cooling waters, based on surface and underground cooling plants, revealed that a surface cooling tower is cheaper, easier to construct and less costly to operate than a surface refrigeration installation. Water in deep mine drains is hotter than the incoming ventilating air, and much of the heat is transferred to the air, making a clear case for pumping this water to settlers. The operating costs of using the alternatives to cool and chill fissure water under summer conditions are tabulated. (Davison-IPA)
W79-07357

POLLUTION OF IRRIGATION REUSE WATER BY PLANT PATHOGENS,
Department of Plant Pathology. University of Nebraska Lincoln.
J. R. Steadman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 115, Price codes: A02 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, June 1979. 16 p, 4 fig, 2 tab. OWRT B-032-NEB(2), 14-34-0001-6096.

Descriptors: *Plant pathogens, Runoff, Water reuse, *Irrigation water.

Systematic sampling of irrigation runoff and reuse systems in Nebraska demonstrated contamination of the water with plant pathogenic fungi and bacteria. In designed reuse systems, nearly 60% of corn fields showing symptoms of Goss's bacterial wilt (Corynebacterium nebraskense) had runoff or reuse samples which were positive for the bacteria in a pathogenicity bioassay. In two instances detection of the organism in the runoff water preceded observation of disease symptoms in the field. Selective assays for many phytopathogens are not available, and attempts to find a simple indicator for waterborne plant pathogens analogous to the coliform test were unsuccessful. An assay utilizing antibiotic resistant strains of phytopathogenic bacteria was developed and enabled chlorine studies to be conducted in natural irrigation reuse water. Phytopathogenic bacteria were similar to Escherichia coli in that low levels of free chlorine were adequate for disinfection. A free chlorine residual of 0.01 to 2.0 mg/l depending on pH and contact time or a combined chlorine residual of 5 to 10 mg/l provided 99% kill. Spores of fungal pathogens, however, required 10-15 mg/l free chlorine for 5 minutes at pH 6.5 for 99% kill. Ammonia plus organic nitrogen and pH had the most significant effect of all water quality parameters tested on chlorine disinfection. Effective chlorination of reuse water may be obtained in the absence of

protected pathogens by injecting directly into the return irrigation pipe.
W79-07393

RECYCLING OF SEWAGE EFFLUENT BY SUGARCANE IRRIGATION: A DILUTION STUDY OCTOBER 1976 TO JUNE 1977 PHASE II-A,
Water Resources Research Center. University of Hawaii Honolulu, Hawaii.
L. S. Lau, P. C. Ekern, P. C. S. Loh, R. H. F. Young, and G. L. Dugan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 148, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 111, August 1977. 52 p, 5 fig, 14 tab, 25 ref, 6 append.

Descriptors: *Dilution, Enteric bacteria, *Sugarcane, *Water reuse, Viruses, Hawaii, Irrigation water, Porvic samplers.

An extension of the recently completed 4-yr project, 'Recycling of Sewage Effluent by Irrigation,' Phase II-A attempts to determine the dilution necessary for an optimal balance of water disposal and sugar yield, to monitor the quantities of nitrogen leaching past the root zone, and to continue monitoring sewage effluent for the presence of human enteric viruses. The reporting period is from October 1976, when the Hawaiian cane variety 59-3775 was planted in the test plots, to June 1977. Five irrigation treatments for the 2-yr cycle with six replicates in a randomized block design were: ditch water; 12.5%; 25%; 50% effluent diluted with ditch water; and effluent the first year and ditch water the second year. Irrigation rounds of up to 10 cm were applied biweekly, and tensiometers in selected test plots monitored water stress conditions. Representative soil samples were collected and analyzed shortly after sugarcane planting. Commercial fertilizer applications of N, P, and K to the 30 test plots were completed in June 1977. Four crop logs were made on sugarcane growth in the test plots. The physical appearance of that growth was very good; however, the relatively low K-H2O index and the high total sugars from the crop log indicate a possible growth imbalance. Due to a very dry winter, rainfall during this period was nearly one-half of normal, whereas, evaporation was more than 50% above normal. The concentration of nitrogen in the soil leachates collected beneath the root zone fluctuates with fertilizer applications, but, after fertilizer applications are completed, increases with the higher percentage of effluent in the irrigation water were observed.
W79-07395

INDUCED RECHARGE ALONG THE LOWER COURSE OF A RIVER--SOME QUALITY ASPECTS FROM A HYDROLOGICAL POINT OF VIEW,
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
K. Maas.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 199-212, 1977. 7 fig, 10 ref.

Descriptors: *Water quality, *Hydrology, *Artificial recharge, *Dispersion, *Rivers, *Water supply, Groundwater, Urbanization, Equations, Hydrogeology, Lower course, Flow.

In urbanized areas the groundwater reserves are often insufficient to satisfy the great demand for water of high quality for public and industrial supply. On hydrological grounds and without relying on the purification during passage through the soil, it can be shown that induced recharge along the lower course of a river is likely to provide a cheap and reliable alternative. (See also W79-07426) (Bell Graf-Cornell)
W79-07448

EAST MESA GEOTHERMAL TEST SITE,
Bureau of Reclamation, Boulder City, NV. Div. of Planning.
For primary bibliographic entry see Field 3A.
W79-07497

3D. Conservation In Domestic and Municipal Use

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

WATER CONSERVATION: RESIDENTIAL IMPACTS,
Arizona State University, Tempe. Faculty of Industrial Engineering.
D. E. Warner.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 522, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis June 1977. 108 p, 4 append, 19 tab, 6 fig, 50 ref.

Descriptors: *Water conservation, *Water demand, *Domestic water, *Water resources, *Water saving devices, Non-consumptive use, Consumptive use, Waste disposal, Waste flow, Recycling, Water rates, Mesa(AZ), Urban water conservation.

The purpose of this study is to determine the constraints and misunderstandings associated with residential water conservation and to analyze the actual savings in dollars, water, and energy that are achieved by the selection and installation of water conserving facilities. Six areas having potentially valuable input to development of a residential water conservation program are: (1) cultural attitudes; (2) institutional impacts; (3) economic aspects; (4) technological alternatives; (5) public education; and (6) residential water usage patterns. These areas are analyzed with regard to their relationship to water saving measures, myths concerning water supply, pricing measures and water conservation, water demand, and other aspects of water conservation. The author investigates the selection and application of water conserving facilities in residential homes in Mesa, Arizona, located in the eastern portion of Maricopa County, 16 miles east of Phoenix. The analysis begins with a brief summary on the growth of Mesa and a discussion of current household water usage and fixture consumption. A review of the water saving devices and appliances to reduce consumption is presented. An acceptable list of water using devices and appliances is developed for consideration in both existing and new homes and each is evaluated for residential unit water savings and costs. Conclusions indicate that residential water conservation would relieve volume loading on sewage facilities and reduce energy demand. Total water savings and costs were also formulated. An appendix lists reasons for reducing water consumption, and another presents a summary of water conserving facilities. (Coan-NC)
W79-07388

3E. Conservation In Industry

RE-USE--THE ESSENTIAL ELEMENT IN WATER UTILIZATION,
Pretoria Univ. (South Africa).
For primary bibliographic entry see Field 6D.
W79-07179

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

3F. Conservation In Agriculture

WATER USE OF POTATOES IN THE TEXAS ROLLING PLAINS,
Texas Agricultural Experiment Station, College Station.
D. G. Bordovsky, C. J. Gerard, and B. D. Kingston.
Report No. PR-3435 C, March 1977. 14 p, 3 tab, 6 fig, 3 ref.

Descriptors: *Consumptive use, *Vegetable crops, *Water utilization, *Crop response, *Irrigation effects, Efficiencies, Moisture uptake, Irrigation practices, Irrigation systems, Sprinkler irrigation, Furrow irrigation, Soil compaction, Soil profiles, Soil water potential, Soil moisture, Dry farming, Texas, Water management(Applied).

Water requirements of potatoes, a crop of economic importance grown on the Texas Rolling Plains, has become of interest as pumping costs from the region's shallow wells has risen. To accumulate data on the water requirements of potatoes, when it should be applied, and how to apply it most effectively, an irrigation study was initiated at the Texas A and M Vegetable Research Station at Munday which analyzed six irrigation schedules and a dryland treatment on Miles fine sandy loam soil. Soil moisture was monitored on all treatments with tensiometers and a neutron probe to a depth of 5 feet throughout the growing season of the Red La Sota variety tested, and plant growth measurements were taken. Crop yield was found to be a linear function of applied irrigation water; and water use accumulated linearly during irrigation when the soil water potential was at .15 atmospheres, indicating a uniform demand curve during this portion of the growing season. Although no statistically different water use efficiencies were found, trends indicated that water use efficiencies were lower on the furrow irrigated plots than on the sprinkled plots irrigated at the same depletion percentage. Soil sampling indicated a relatively compacted sandy layer was restricting root development to the top foot of the soil profile, and profile modification by deep chiseling or plowing is suggested to increase the reservoir from which the crops can draw water. Dryland treatment had a significantly lower yield than all irrigated treatments. (Tickes-Arizona)
W79-07124

PLANT PHYSIOLOGICAL RESPONSES TO WATER STRESS,
Nebraska Univ., Lincoln. Dept. of Horticulture.
C. Y. Sullivan, and J. D. Eastin.
Agricultural Meteorology, Vol. 14, p 113-127, 1974. 2 fig, 6 tab, 63 ref. OWRT-A-026-NEB(2).

Descriptors: *Plant physiology, *Drought resistance, *Moisture stress, *Crop response, Plant growth, Proteins, Root systems, Stomata, Water balance, Photosynthesis, Moisture content, Moisture uptake, Water requirements, Equilibrium.

Water use efficiency of plants grown under drought conditions, physiological responses to water stress, and factors contributing to conventional drought resistance are discussed. Experimental work with two sorghum hybrids showed the existence of genotype differences in response to water stress and critical water potentials. Dehydration, or desiccation tolerance, is the equilibrium relative humidity, or water potential, causing 50% killing of the cells. Differences were also found in the ability of different species and varieties to harden in response to drought exposure. A natural hardening period, or previous exposure to water stress conditions, significantly influenced measured responses, such as photosynthesis and stomatal movement. The growth stage at which the stress occurs also influences the response. From the results of drought and heat tolerance tests it is con-

cluded that genetically controlled tolerance factors can be selected for and used in plant breeding programs. (Davison-IPA)
W79-07170

ORCHARD IRRIGATION SCHEDULING: RESULTS OF A PRELIMINARY INVESTIGATION,
Elgin Co-operative Fruit Growers, Ltd. (South Africa).
A. Fochessati.
The Deciduous Fruit Grower, Vol. 28, part 8, p 290-299, August 1978. 6 fig, 1 tab.

Descriptors: *Irrigation, *Irrigation design, *Irrigation efficiency, *Water management(Applied), *Irrigation programs, Orchards, Surface irrigation, Water utilization, Consumptive use, Crop production, Moisture uptake, Optimum development plans, Orchards, Southern Africa.

To estimate the rate and frequency of irrigation for any application during the growing season the influence of the following factors must be assessed with regard to the time of the season: (1) climate including temperature, wind, and humidity; (2) type of ground cover in the orchard; (3) total leaf area of both the trees and the cover crop; (4) water retention capacity of the soil in the root zone; (5) irrigation method and the relative efficiency of water utilization; and (6) orchard aspect. An investigation being conducted in an apple orchard is described in which evaporation data obtained from an evaporimeter is used. In assessing the values of a rainfall and an equivalent volume of water applied by microjets the quantity of water consumed by the trees at various stages during the season must be considered. The difference between consumptive requirements of the tree and actual water consumed to satisfy this requirement can be attributed to the method of application. In orchards where strip irrigation is employed the area watered is restricted to less than half the total ground surface. Where irrigation application is over the entire surface, evapotranspiratory losses are increased by the water consumption of the sod grown in the alleyways and evaporation from the larger surface area which includes the sod leaf surface area and the soil immediately below the surface. When a pattern of irrigation requirement has been developed and the 'crop factor' worked out evaporation records can be used to determine irrigation scheduling according to seasonal needs. (Davison-IPA)
W79-07174

AN ECONOMIC FEASIBILITY STUDY OF IRRIGATED CROP PRODUCTION IN THE PECOS VALLEY OF TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
G. D. Condra, R. D. Lacewell, D. C. Hardin, K. Lindsey, and R. E. Whitson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 896, Price codes: A09 in paper copy, A01 in microfiche. Research Project Interim Report No. 101, March 1979. 184 p, 3 fig, 19 tab, 96 ref, 7 append. OWRT A-037-TEX(5). 14-34-0001-7091, 7092 and 8046.

Descriptors: *Economic analysis, Profitability, Investment analysis, *Irrigation, Linear programming, Simulation, Texas.

A modified MOTAD linear programming-simulation model was developed to generate estimates of survival and profitability by recursive simulation of multiple time periods, as follows: (1) development of a farm plan, (2) generation of stochastic prices and yields, (3) simulation and evaluation of the farm plan in operation, and (4) update of the planning situation to reflect adjustments in expected prices, expected yields, and credit restrictions. The model then returns to step 1 for simulation of the next time period. The model was applied to the Coyanosa and St. Lawrence regions under alternative future scenarios for inflation rates, energy prices, crop prices and interest rates. The Coyanosa farm survived about 8 years under the optimistic scenario and 5 years under all other scenarios. The most likely rate of survival was 20-30 percent with a range of 10 percent to 65 percent for other scenarios. The average life and rate of survival was higher for the St. Lawrence farm under all scenarios. It was concluded that (1) survival and profitability of irrigated crop production in the Coyanosa area will depend greatly upon future levels of inflation, energy prices, crop prices, and interest rates, (2) survival and profitability for Coyanosa will most likely be lower than St. Lawrence, and (3) land purchase provides greater potential survival and profitability than traditional crop share rental arrangements.
W79-07253

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

RECYCLING OF SEWAGE EFFLUENT BY SUGARCANE IRRIGATION: A DILUTION STUDY OCTOBER 1976 TO JUNE 1977 PHASE II-A,
Water Resources Research Center. University of Hawaii Honolulu, Hawaii.
For primary bibliographic entry see Field 3C.
W79-07395

SPEED CONTROL MEANS FOR CENTER PIVOT IRRIGATION SYSTEM,
Toro Co., San Marcos, CA. (Assignee).
E. J. Hunter, R. E. Hunter, and R. W. Cudworth.
U.S. Patent No. 4,135,539, 13 p, 13 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 978, no 4, p 1228, January 23, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Irrigation practices, Irrigation efficiency, Hydraulic systems, Hydraulic equipment.

A method and apparatus for operating a center pivot irrigation system includes span units, each having a drive carriage having a hydraulically driven motor. Hydraulic fluid is supplied at a selectable value of constant volume fluid flow to the system to drive the system at a selectable average speed about its center pivot. The flow rate of fluid to individual motors of individual span units which are ahead or behind a predetermined relative alignment with the other span units is varied in response to changes in angularity sensed between adjacent span units in both forward and backward directions relative to the direction of travel of the system about its center pivot while the constant volume fluid flow through the system is being maintained at a selectable constant flow rate. An improved hydraulic adjustable rate flow valve accommodates fluid flow in reversible directions while maintaining close control or metering capabilities over the fluid flow through the valve in either flow direction. (Sinha-OEIS)
W79-07396

SOAKER HOSE SUPPORT,
Alpha Nova Development Corp., Santa Ana, CA. (Assignee).
R. J. Winkler, C. G. Harris, and T. A. Sprague.
U.S. Patent No. 4,135,668, 5 p, 10 fig, 12 ref; Official Gazette of the United States Patent Office, Vol. 978, no 4, p 1271, January 23, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, Application equipment, Soaker hose.

A support assembly for a flat soaker hose is comprised of a spike insertable into the ground with mounting provisions at the top end for a clamp assembly which can be placed at various angular positions. The clamp assembly has a number of cantilevered fingers placed in staggered opposing alignment which provide clearance equal to the nominal dimension of a hose when unpressurized. The clamp is insertable at various angular dispositions into the upper end of the spike or it may be attached to a ball swival mount and the upper end of the spike of provided with a split ball seat drawn tight by a wing nut arrangement. The edges of a flat soaker hose are grasped by the clamp and subsequent pressurization of the hose increases the securing interlock. (Sinha-OEIS)
W79-07398

WATER ACTIVATED STOP FOR SPINNERS,
H. S. Ausherman.
U.S. Patent No. 4,136,826, 5 p, 3 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1665, January 30, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Application equipment, Irrigation efficiency, Irrigation practices, Water conveyance, Irrigation spinners.

Spinners mounted on the main water distribution pipe of a center pivot irrigation system are free to continue to rotate when the water pressure to the spinners is turned off. Also, the spinners are free to rotate when contacted by the wind. The continued rotation of the spinners, which are connected to a vertical spinner drive shaft which is used for driving rubber tired drive wheels, allows continued movement of the irrigation system causing the equipment to travel in an irregular path. This invention describes a water activated stop device which is connected to the water in the main water distribution pipe and is held in a disengaged position when water pressure is applied. When water pressure is turned off a stop arm attached to a pivot arm engages a spinner rod attached to the rotating spinner shaft and prevents continued rotation of the spinners. (Sinha-OEIS)
W79-07409

PHOSPHORUS SUPPLYING CAPACITIES OF PREVIOUSLY HEAVILY FERTILIZED SOILS,
Universidade Federal de Vicosa (Brazil). Dept. of Soils.
For primary bibliographic entry see Field 2K.
W79-07492

RESIDUAL NITRATE-N IN FINE SAND AS INFLUENCED BY N FERTILIZER AND WATER MANAGEMENT PRACTICES,
Science and Education Administration, Akron, CO.
D. E. Smika, and D. G. Watts.
Soil Science Society of America Journal, Vol. 42, No. 6, p 923-926, November-December, 1978. 5 fig, 1 tab, 6 ref.

Descriptors: Nitrogen, *Nitrates, *Nitrification, Application methods, *Irrigation systems, Groundwater, Return flow, Corn.

On fine sandy soils fertilizer N and water management are the key to controlling NO3(-)N movement below the root zone of an irrigated corn crop. When the N was applied in one broadcast application at seeding, very little NO3(-)N remained in the soil at the end of the growing season, regardless of the amount of growing season water application. Overwinter leaching of NO3(-)N below the 150-cm sampling depth was minimal with 13 cm of precipitation received during these months. When N was applied through the solid set sprinkler irrigation system during the growing season before tasseling, water application rate and total N applied determined the amount of NO3(-)N that remained in the soil at the end of the growing season. During the overwinter period, NO3(-)N actually increased in the soil due to nitrification of some of the NH4(+)-N. With proper N application and water management, the potential for NO3(-)N leaching below the crops' root zone can be greatly reduced. (Skogerboe-Colorado State)
W79-07493

CORN YIELD RESPONSES TO WATER STRESS MANAGEMENT,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W79-07500

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DRAFT ENVIRONMENTAL IMPACT STATEMENT: GREENSBORO-GUILFORD COUNTY, NORTH CAROLINA, 201 WASTEWATER TREATMENT SYSTEM, EPA PROJECT NOS. C37037601, C37036901.
Environmental Protection Agency, Atlanta, GA. Region IV.
For primary bibliographic entry see Field 5D.
W79-07053

FINITE ELEMENT ANALYSIS OF THREE-DIMENSIONAL WIND-DRIVEN FREE SURFACE FLOWS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
C. T. Kincaid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 726, Price codes: A12 in paper copy, A01 in microfiche. Doctoral Dissertation, 1979. 265 p, 20 fig, 20 tab, 6 append. OWRT B-139-UTAH(4). 14-34-0001-7191.

Descriptors: *Finite element analysis, Wind tides, Fluid flow, Fluid mechanics, Viscous flow, Shear, Surface waters, Great Salt Lake, Navier-Stokes equation, Poisson's equation.

The purpose was to develop a numerical model of three-dimensional, viscous, incompressible flows with a free surface. Driving forces included wind-induced shear, free surface set-up, bottom shear, and Coriolis. An uncoupled solution of the Navier-Stokes equations for velocity and a Poisson's equation for pressure was presented. The assumption of hydrostatic pressure reduced the pressure variable to one of free surface elevation. The analysis was performed with two and three-dimensional elements characterized by their multiple degree of freedom nodes and cubic interpolation on element edges. A new free surface element was developed which employs C1 interpolation of the free surface and C0 interpolation for the problem interior. This hybrid Bogner-Adini element was coupled with a Bogner element model of the free surface and an Adini element model of the interior fluid domain. Sparcely discretized cube and shallow rectangular cavities were used to test the model's similative ability. These hypothetical problems were necessary due to the relatively poor cost effective character of the numerical analysis. Vertical recirculation was shown for the cube cavity, while horizontal recirculation was suggested by the shallow cavity solutions. Stability of computation was related to eddy viscosity and characteristic length via an elemental Reynolds number. Further refinement and application of the model to actual lakes was left to future research.
W79-07165

ON THE DISSOLVED SOLIDS OF THE PONGOLO FLOOD PLAIN PANS,
Natal University, Pietermaritzburg (South Africa).
J. Heeg, C. M. Breen, P. M. Colvin, H. D. Furness, and C. F. Musil.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 59-64, July 1978. 8 fig, 1 tab, 13 ref.

Descriptors: *Flood plains, *Pongolo River(South Africa), *Water analysis, *Dissolved solids, *Anions, *Flooding, Environmental effects, Solutes, Soils, Seepage, Seepage water, Irrigation water.

Data are presented from a comprehensive survey conducted after the impounding of all flood water in the Pongolopoort dam in 1970 and an ensuing prolonged dry winter, and routine monitering conducted when the impounded water was periodically released during the summer months of 1975 and 1976. Determination of major cation concentrations was made from water samples collected from selected pans on the flood plain. The water in the Pongolo flood plain pans contains higher total dissolved solids than the Pongolo River, and the composition of the solutes approximates seawater in equivalent ionic proportions at high concentrations. These solutes originate from highly mineralized seepage water characteristic of soils overlying Cretaceous sediments of marine origin. This precludes the use of irrigation seepage water to maintain the water levels in the pans. Therefore, to maintain the present biological characteristics of the pans, the system must be flushed by the release of simulated floods from Pongolopoort Dam. (Davison-IPA)
W79-07187

URBANIZING IRRIGATED VALLEYS FOR OPTIMUM WATER USE,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 4C.
W79-07197

STORM WATER MANAGEMENT FOR NEPEAN, MERIVALE AREA,
Gore and Storrie Ltd., Toronto (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Environmental Protection Service, Environment Canada, Ottawa, Canada; Ontario Ministry of the Environment, Toronto, Ontario, Canada, Research Report No. 89, 71 p, 18 fig, 10 tab. 74-8-10.

Descriptors: *Storm water, *Storm runoff, *Water management(Applied), Storm drains, Rainfall-runoff relationships, Pollutants, *Rideau River, Storage, Treatment overflow, Model(STORM), Storm Water Managemet Model(SWMM).

A detailed analysis of the quantity and quality of storm runoff from the Merivale area of Nepean, Ontario, to the Rideau River was carried out. The Merivale area watershed comprised 1300 acres of industrial (705 acres), residential (135 acres) and open land (460 acres). An open ditch storm drainage system collects and transports runoff from the originally developed areas to Nepean Creek, and ultimately to the Rideau River. The newly developing area of Merivale Acres Industrial Colony is serviced by storm sewers which drain to a 120 inch diameter main trunk sewer routed through the development area. A main trunk and local sewer system plan has been developed to service the entire area. The Rideau River has been identified by the Ontario Ministry of Environment as a particularly sensitive watercourse with a limited ability to assimilate polluting discharges. The Storage, Treatment Overflow Runoff Model (STORM), developed by the U.S. Army Corps of Engineers, was used in this analysis for continuous simulation of rainfall and runoff based on hourly precipitation data. The Storm Water Management Model (SWMM), as developed by the U.S. Environmental Protection Agency, was used to simulate specific storm events. These models generated quantity and quality information for storm runoff from the area. Based on this information, three storm water management control and treatment alternatives were prepared. Estimated costs for the proposed control and treatment alternatives are provided. (WATDOC)
W79-07226

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: AN OVERVIEW (VOLUME 1),
Wisconsin Univ.-Madison. Law School.
For primary bibliographic entry see Field 6E.
W79-07232

ADOPTION OF THE REASONABLE USE RULE IN NORTH CAROLINA FOR SURFACE WATER DRAINAGE BETWEEN ADJOINING LANDOWNERS,
For primary bibliographic entry see Field 6E.
W79-07235

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07239

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07250

A PROPOSED WATER RESOURCES CODE OR STATUTE: ARIZONA WATER RESOURCES MANAGEMENT ACT OF 1977,
Arizona Univ., Tuscon. Coll. of Law.
For primary bibliographic entry see Field 6E.
W79-07257

A GEOGRAPHICAL ANALYSIS OF TRENDS IN UNITED STATES WATER RIGHTS LAWS (WITH EMPHASIS ON THE SOUTHEASTERN STATES),
Michigan Univ., Ann Arbor. Dept. of Geography.
For primary bibliographic entry see Field 6E.
W79-07258

PROTECTING INSTREAM FLOWS UNDER WESTERN WATER LAW - SELECTED PAPERS,
Office of Biological Services, Fort Collins, CO.
For primary bibliographic entry see Field 6E.
W79-07260

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

WATER, WATER: EDITORIAL COMMENT,
Citrus and Subtropical Fruit Journal, No. 535, p 1 and 14, June 1978.

Descriptors: *Water resources development, *Planning, *Project planning, *Water reuse, *South Africa, Water requirements, Consumptive use, Industrial water, Agriculture, Water demand, Water storage, Resources development, Effluents, Waste water treatment.

A South African Commission of Enquiry into Water Matters found that 40% of the country's water resources was being used in 1970, and 100% of the current available resources would be used up by the turn of the century. Existing water storage capacity and storage capacity under construction in 1970 was 9.3 morgen ft (a morgen ft is equal to 576,250 gals). It is expected that by the year 2000 the Orange River Project will have increased storage capacity to 30 million morgen ft. The major economic regions of the country will require an estimated total of 2,934 million gals/day by then. During 1977 the Water Research Commission financed water research projects involving the CSIR, industries, government departments, local authorities, universities, and a provincial authority under the principle of partnership research in which potential users of research results are involved in the planning and execution of the projects. This represents a savings on direct research expenditure in addition to promoting tech-

nology transfer. Production costs of reclaimed water at the Stander Water Reclamation Plant, Daspoort, Pretoria, were 20% less than a year ago. Research at this plant is directed towards the development of design and operational criteria for the fullscale application of water reclamation in South Africa. (Davison-IPA)
W79-07352

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION I,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07372

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION II,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07373

SPECIAL FLOOD HAZARD INFORMATION REPORT: DEER CREEK, GLENROCK, WYOMING.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W79-07374

SPECIAL FLOOD HAZARD INFORMATION, SNAKE RIVER, WILSON, WYOMING AND VICINITY.
Army Engineer District, Walla Walla, WA.
For primary bibliographic entry see Field 2E.
W79-07375

SPECIAL FLOOD HAZARD INFORMATION: WALNUT CREEK, SPRINGTOWN, TEXAS.
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 2E.
W79-07378

FLOOD PLAIN INFORMATION: NATRONA COUNTY, WYOMING, NORTH PLATTE RIVER.
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 2E.
W79-07379

FLOOD HAZARD ANALYSES: NORTH FORK RUSH CREEK, HENNEPIN COUNTY, MINNESOTA,
Soil Conservation Service, St. Paul, MN.
For primary bibliographic entry see Field 2E.
W79-07381

SUBURBAN DRAINAGE,
Ohio Legislative Service Commission, Columbus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 267, Price codes: A05 in paper copy, A01 in microfiche. Staff Research Report No. 124, 1977. 74 p, 1 append.

Descriptors: *Storm runoff, *Drainage, *Urban drainage, *Municipalities, *Ohio, *County Ditch Law, Urban areas, Urban runoff, Surface drainage, Drainage effects, Storm drains, Public projects, Sewer districts, Sanitary districts, Financing, Zoning, Fees, Taxes, Assessments.

This report deals with suburban drainage problems and methods of initiating and financing needed drainage improvements in suburban areas. It focuses on drainage problems in Ohio's suburbs, existing Ohio laws and practices concerning these problems, and proposals to deal more effectively with suburban drainage. The distinctive characteristics of suburban drainage, actual drainage problems in Ohio suburbs, and possible means of preventing future drainage problems are presented with a discussion on how adequate planning can prevent these problems. Possible legislative actions to rectify drainage problems include requiring subdivisions to enact zoning ordinances, drainage regulations, or subdivision regulations that govern water runoff. Planning commissions could be permitted to charge developer fees to pay for regulation of the additional water runoff the development will cause. The report also discusses Ohio Court decisions on suburban drainage, and difficulties landowners encounter in resolving suburban drainage disputes through the courts. The statute specifying county drainage powers, the County Ditch Law, is described and evaluated along with township drainage powers. Ohio courts have not formulated a prevailing rule governing suburban drainage disputes. Generally, a landowner may recover damages if these damages result from artificial drainage rather than from natural watercourse drainage. The report differentiates between incorporated and unincorporated suburban areas and discusses their particular problems and remedies. (Coan-NC)
W79-07385

PROCEEDINGS, NORTH CAROLINA WORKSHOP ON MANAGEMENT OF STORMWATER, SEDIMENTATION AND FLOOD CONTROL IN URBAN AREAS,
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
n.d., 55 p.

Descriptors: *Stormwater management, *Sedimentation, *Flood control, Erosion, Urban drainage, Urban runoff, North Carolina, Local government, Legislation, Ordinances, Regulatory practices.

The North Carolina Workshop on Management of Stormwater, Sedimentation and Flood Control in Urban Areas was held January 5, 1978, in Apex, North Carolina. The objectives of the workshop were: (1) to develop an overview document on appropriate unified local and state control strategies for stormwater quality, sedimentation and erosion, urban drainage, and flood control; (2) to assess needs for research projects for new investigations leading to possible new legislation; and (3) to provide a mechanism for experience-sharing and coordination between persons working in the subject fields. The workshop was devoted entirely to questions of administration and management, legislation, ordinances, and regulatory practices. It consisted of prepared presentations and directed discussions. The morning session included presentations by state and local officials, and the afternoon session consisted of a workshop where a summary policy paper was developed. These proceedings contain the papers presented and the workshop results, as well as the lists of task force members and attendees. Although not all material which was available at the workshop is contained in these proceedings, it is intended to provide a resource document for state and local governments in developing improved management procedures for these program areas. (Kiger-North Carolina)
W79-07389

CATCH BASIN INTERCEPTOR,
Calspan Corp., Buffalo, NY. (Assignee).
For primary bibliographic entry see Field 2E.
W79-07401

THE EFFECTS OF AN URBAN AREA ON THE WATER MANAGEMENT OF A RURAL AREA,
Cultuurtechnische Dienst, Utrecht (Netherlands).
H. M. A. Kempen, and H. Ton.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 59-62, 1977.

Descriptors: *Effects, *Water management(Applied), *Drainage systems, *Rural areas, Urban areas, Rainfall, Floods, Channels, Water level, Groundwater, Wooden piles, Building foundations.

The discharge in a rural drainage system resulting from rainfall in built-up areas has been simulated by models of nonstationary flow. The results show that when floods are likely to occur in an existing system, the widening of the drainage channel along a few hundred metres is all that is required. This solution is much less drastic and cheaper than the construction of storage ponds. The foundations of many buildings are on wooden piles, and it is essential that these piles stay below groundwater level. In projects for rural development the water table is often lowered putting the foundations of existing buildings at risk. It is possible to remedy this by local injections of water to maintain the water level at the foundations. If the buildings are sufficiently far from the drainage channels additional measures are not necessary. (See also W79-07426) (Bell Graf-Cornell)
W79-07434

INTEGRATED USE OF RESERVOIRS IN URBAN AREAS,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
A. B. Avakyan, V. P. Saltankin, and V. A. Sharapov.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 226-230, 1977.

Descriptors: *Urban hydrology, *Water resources development, *Moscow(USSR), Water supply, Water conservation, Reservoirs, Irrigation, Water pollution control, Environmental protection, Water quality, Water demand.

Developing society imposes heavy demands on the amount and quality of water used in urban areas. The important aspects of this problem are water supply for domestic and industrial uses, replenishment of water resources, irrigation, recreation, pollution control of water bodies and environmental protection in water-land complexes. These are discussed as applied to the built-up area of Moscow. (See also W79-07426) (Bell Graf-Cornell)
W79-07450

ENVIRONMENTAL IMPLICATIONS OF SERVICE RESERVOIRS,
H. Bandler.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 231-237, 1977.

Descriptors: *Service reservoirs, *Environmental effects, *Sydney(Australia), Safety, Recreation, Aesthetics, Water distribution(Applied), Underground, Characteristics, Roof area.

Use of service reservoirs goes back to antiquity. Size, shape, location and building materials vary. Safety of construction is important for the community. Environmental aspects of water distribution reservoirs in Sydney differ. The least environmental impact is from underground reservoirs, but the roof area should be available for recreation. Most are built above ground for economic reasons; they can be enhanced environmentally by architectural treatment, painting and landscaping. Creative efforts have to be made to fulfill aesthetic requirements. (See also W79-07426) (Bell Graf-Cornell)
W79-07451

4B. Groundwater Management

PONDING-TEST PROCEDURE FOR ASSESSING THE INFILTRATION CAPACITY OF STORM-WATER BASINS, NASSAU COUNTY, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
R. C. Prill, and D. A. Aronson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.50. Geological Survey Water-Supply Paper 2049, 1978. 29 p, 13 fig, 4 tab, 11 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Testing procedures, *Ponding, *Infiltration rates, Unsaturated flow, Hydrogeology, Aquifer characteristics, Storm runoff, Hydraulic conductivity, Planning, Evaluation, Aquifer management, *Long Island(NY).

A procedure to obtain field data for assessing performance of storm-water basins having high infiltration rates is described. The basin selected was divided into test plots, and treated municipal water from a fire hydrant was ponded to the desired depth so that infiltration rates and flow patterns in the unsaturated zone could be determined by standard methods. The study was made at a storm-water basin excavated in glacial outwash deposits in Nassau County, Long Island, N.Y. in 1971-72. The types of interpretations and evaluations that can be made from test data are described, and applications of the procedure as well as guidelines for developing a similar testing program are given. Observations of special significance were: (1) Infiltration rate of the basin at low water stage is about 1.5 feet per hour but increases with increased water level; (2) flow through the unsaturated zone is essentially vertical; (3) infiltration rate is controlled by a surface stratum--in this case a gravelly, sandy loam; and (4) the position of the water table has little effect on infiltration rate provided it is below the lower boundary of the controlling zone. These observations can be used in evaluating a storm-water basin's suitability for supplemental recharge with treated wastewater, in comparing procedures for increasing a basin's infiltration capacity, or in the design of new storm-water basin systems. (Woodard-USGS)
W79-07012

SELECTED CHEMICAL CHARACTERISTICS OF SOILS, FORAGES, AND DRAINAGE WATER FROM THE SEWAGE FARM SERVING MELBOURNE, AUSTRALIA,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-07079

URBANIZING IRRIGATED VALLEYS FOR OPTIMUM WATER USE,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 4C.
W79-07197

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: AN OVERVIEW (VOLUME 1),
Wisconsin Univ.-Madison. Law School.
For primary bibliographic entry see Field 6E.
W79-07232

ADOPTION OF THE REASONABLE USE RULE IN NORTH CAROLINA FOR SURFACE WATER DRAINAGE BETWEEN ADJOINING LANDOWNERS,
For primary bibliographic entry see Field 6E.
W79-07235

GROUNDWATER POLLUTION IN SOUTH DAKOTA: A SURVEY OF FEDERAL AND STATE LAW,
For primary bibliographic entry see Field 6E.
W79-07247

A PROPOSED WATER RESOURCES CODE OR STATUTE: ARIZONA WATER RESOURCES MANAGEMENT ACT OF 1977,
Arizona Univ., Tuscon. Coll. of Law.
For primary bibliographic entry see Field 6E.
W79-07257

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

GROUNDWATER WITHDRAWAL AND WATER CONTROL IN THE NETHERLANDS. HOW TO INCREASE THE POSSIBILITIES OF EXPLOITING GROUNDWATER BY ADEQUATE WATER MANAGEMENT,
Cultuurtechnische Dienst, Utrecht (Netherlands).
H. G. Broeze, and T. Couwenhoven.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 179-187, 1977. 1 fig, 4 tab, 5 ref.

Descriptors: *Groundwater, *Withdrawal, *Water management(Applied), *The Netherlands, Drainage, Agricultural, Groundwater extraction, Geohydrology, Deep wells, Pumping, Surface waters, Drawdown, Water supply, Soils.

In the Netherlands, the growth in the population in combination with an increasing degree of industrialization over the last few decades has led to a rapid increase in the extraction of groundwater for domestic and industrial supplies. As a result of the hydrogeological conditions, most of the groundwater extraction causes a drawdown of the groundwater table. This can influence agricultural production and the natural environment, because in most of the Netherlands, the groundwater table is found within 1 or 2 m of the soil surface, and thus the capillary fringe reaches the root zone. Also, the discharge of brooks and rivers can be reduced by groundwater extraction. These effects can be only partly compensated for by the supply and conservation of surface water. Consequently, the issue of licenses for groundwater extraction is at present limited. The use of surface water for the production of drinking water is still a very expensive alternative, compared with the use of groundwater. Therefore, the relationship between groundwater and surface water has been studied in order to find ways to optimally manage the hydrological system. In agricultural and municipal areas, measures are taken to prevent damage caused by excess water in rainy periods. It is plausible that these measures can partly remain in obeyance when the groundwater level is lowered by groundwater extraction. Further, the existing system of ditches in agricultural areas can be used for agricultural water supply as well as to replenish the groundwater. In both cases, a synthesis between the objectives of the interested parties is pursued on behalf of optimal water management. (See also W79-07426) (Bell Graf-Cornell)
W79-07446

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGY AND CHEMICAL QUALITY OF FLOW FROM SMALL PASTURED WATERSHEDS: I. HYDROLOGY,
Ohio Agriculture Research and Development Center, Wooster.
For primary bibliographic entry see Field 2A.
W79-07132

URBANIZING IRRIGATED VALLEYS FOR OPTIMUM WATER USE,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. UP1, p 41-49, January 1979. 5 fig, 16 ref.

Descriptors: *Irrigated land, *Valleys, *Urbanization, *Arid lands, Water utilization, Water reuse, Optimum development plans, Flooding, Sewage effluents, Storm runoff, Ground water recharge, Water management(Applied), Salt balance, Water levels, Deep percolation.

Irrigated valleys of the southwestern United States and other arid lands are prime areas for urbanization through expansion of existing towns in these valleys since it is easier to build on flat land where water and roads are already available. Irrigated valleys frequently have limited water supplies with most of the available water being used for irrigation. Urbanization in the valleys results in loss of irrigated land, increased flooding and reduced opportunities for reuse of sewage effluent. These disadvantages can be avoided if urbanization were to take place on the nonirrigated higher lands (deserts, foothills, etc.). Storm runoff from these lands would be spread over the lower agricultural land for irrigation and ground water recharge. Ground water management of an irrigated valley must achieve a salt balance for the entire valley to assure permanent irrigation. Where ground water levels are low, they can be brought up by a reduction in irrigation or by additional ground water recharge. Once ground water levels are sufficiently high, a program of balanced withdrawal and replenishment of ground water can be instituted to avoid long-term ground water declines. (Purdin-NWWA)
W79-07197

WOOD DRIVING OPERATIONS IN SWEDEN AND FINLAND.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Economic and Technical Review Report EPS 3-WP-78-6, 1978. 73 p, 43 fig, 3 append.

Descriptors: *Pulp and paper industry, *Lumbering, *Transportation, Water conveyance, Legislation, Environmental effects, Fish, Sewage lagoons, *Sweden, *Finland, Lake Saimaa, Kemi River.

Report of a visit by a group of Federal Government/Industry representatives, August 16 - September 1, 1976. In August, 1976, a group of four Canadians representing the Federal Department of the Environment, and the Canadian pulp and paper industry visited Sweden and Finland to observe wood driving operations. This report describes information obtained on methods of transporting wood, legislation regarding water transport of wood, volumes driven, and environmental and other problems encountered in transporting wood by water in these countries. Wood driving companies and sites were visited and are also described. (WATDOC)
W79-07218

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07250

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

INSUFFICIENT EIS HALTS HYDRO-ELECTRIC PROJECT,
For primary bibliographic entry see Field 6E.
W79-07279

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

HYDROGRAPHIC PROJECT,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 2A.

W79-07289

ASSESSING MAN'S IMPACT ON WETLANDS,
Military Academy, West Point, NY.
G. E. Galloway, Jr.
University of North Carolina Water Resources Research Institute, Raleigh Report No. 136, December 1978. 115 p, 49 fig, 3 tab, 68 ref, 3 append. Also as Sea Grant Publication UNC-78-17.

Descriptors: *Wetlands, *Environmental effects.

The report summarizes an approach to properly define the relative impacts of proposed projects on wetlands. It provides a short background on federal interest in wetlands and a discussion of how, when, and where man's impact on wetlands occurs. The next section focuses on impact assessment, first by defining the characteristics of a usable evaluation system and then by briefly surveying current evaluation techniques. The third section proposes the Wetland Evaluation System (WES). The fourth section applies this model, for illustrative purposes, to abbreviated case studies of wetland evaluation in the Yazoo Basin of Mississippi and the Neuse River Estuary of North Carolina. Comments are included on the utility of the WES and the concepts contained within the WES. (Kiger-North Carolina)
W79-07392

EFFECTS OF URBANIZATION ON THE DISTRIBUTION OF FRESH AND SALINE GROUNDWATER IN THE NETHERLANDS,
Technische Hogeschool, Delft (Netherlands).
J. C. van Dam, and W. H. C. ten Hoorn.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977, IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 488-499, 1977. 8 fig, 3 ref.

Descriptors: *Effects, *Urbanization, *Freshwater, *Saline water, *Groundwater, *Netherlands, Water level, Flow, Chlorine, Equations, Hydrology, Aquifers, Saline water-freshwater interfaces, Recharge, Subsoil, Rhine River basin, Holocene formations, Semipermeable layers, Geological history.

About 25 percent of the Netherlands is below mean sea level, and this is also the case with the greater part of the densely urbanized western part of the country. Owing to the geological history, saline water is found in the subsoil, and in some deeper polders saline seepage reaches the surface water. New town developments are often realized in polders, in which case, in order to obtain good drainage, either the surface must be raised, or the polder level lowered. The last solution is, as a rule, the cheapest, but lowering the polder level means a rise of the interface between the fresh and saline groundwater and consequently a greater chance of saline seepage. A good insight into the present occurrence of saline groundwater is necessary, together with the ability to predict the consequences of changes in the level of groundwater and/or surface water. For a one-dimensional, steady case a calculation is given, whereas for the more complicated cases the means of achieving a solution are given. (See also W79-07426) (Bell Graf-Cornell)
W79-07480

EFFECTS OF URBANIZATION ON WATER MANAGEMENT IN THE WESTERN PART OF THE NETHERLANDS,
Technische Hogeschool, Delft (Netherlands).
H. Hengeveld, J. van der Kley, and J. Luijendijk.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 500-513, 1977. 6 fig, 6 tab, 5 ref.

Descriptors: *Effects, *Urbanization, *Water management(Applied), *Netherlands, Drainage, Planning, Governments, Pumping, Natural discharge, Paved surfaces, Water systems, Urban areas, Rural areas.

Described are the quantitative effects of urbanization on water management in the western part of the Netherlands during the last hundred years. Particularly, the increase of paved surfaces is investigated. Moreover, the development of the water management system and more specifically the ways in which urban areas are related to the whole system are studied. A number of specific drainage methods is discussed. The effects of urbanization on the water systems in urban areas, on the water systems in the adjacent rural areas, and on the catch water basin are indicated. This analysis and the analysis of the urbanization plans of the Netherlands Government are used to draw conclusions regarding the effects of future urbanization on the water management system. (See also W79-07426) (Bell Graf-Cornell)
W79-07481

THE WATER SUPPLY OF MARRAKESH: SHORT, MEDIUM AND LONG TERM SCHEMES. INFLUENCES ON THE WATER TABLE, (IN FRENCH),
Ministere des Travaux Publics et des Communications, Rabat (Morocco). Direction de l'Hydraulique.
A. Kabbaj, I. Zeryouhi, and Th. Pointet.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 514-519, 1977. 1 fig, 1 tab.

Descriptors: *Water supply, *Effects, *Water table, *Marrakesh(Morocco), Forecasting, Optimum development plans, Surface waters, Groundwater, Water utilization, Water requirements, Irrigation water, Infiltration, Diversion.

Tourist developments in the city of Marrakesh, Morocco, are causing an overall growth and a particularly rapid increase in the needs for water. The forecast of these needs and their solutions will be integrated from 1981 onwards in a group scheme for the exploitation of the Haouz plain. This scheme foresees the optimal utilization of the surface and groundwater resources of the basins. It will utilize an important water supply that will be diverted from the neighboring basin of Tassaout. A temporary over-exploitation of the water table will be called for and the effects of this have been researched. From 1981, the reestablishment of the piezometric level will be ensured by the infiltration of excess water from irrigation. (See also W79-07426) (Bell Graf-Cornell)
W79-07482

WATER SUPPLY AS A LIMITING FACTOR IN DEVELOPING COMMUNITIES: LOCAL VERSUS REGIONAL SOURCES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Geography.
R. M. Hordon.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 520-525, 1977. 1 fig, 1 tab, 17 ref.

Descriptors: *Water supply, *Urban development, *Local sources, *Regional sources, *New Jersey, Population growth, Planning, Groundwater, Aquifers, Recharge, Governments, Baseflow diminishment, Yield decrementing, Atlantic coastal plain(NJ), Land development capacity.

A growing number of developing communities in New Jersey are planning for an ultimate population that would be supplied only by local sources of water. At the state and national level, however, reliance on regional sources appears to be in favor. Both viewpoints recognize that water supply is a major critical factor in determining the capacity of a land area to support a population. Three planning issues that bear in this local-regional source controversy are discussed: (1) deep confined aquifers which have recharge areas in other political jurisdictions and are therefore regulated by other governing bodies will not count as a local source, i.e., reliance will be placed only on shallow water table aquifers which are recharged by local precipitation; (2) total development of the groundwater resources of a headwaters community could result in severe base-flow diminishment, thereby supporting the notion that these communities have a regional responsibility to restrict their growth so as to preserve and protect the water supply for downstream users; and (3) yield decrementing estimates, i.e., how much recharge water is lost to runoff as a consequence of development, are needed in order to assess the magnitude of local water resources. (See also W79-07426) (Bell Graf-Cornell)
W79-07483

THE RELATIONS BETWEEN WATER MANAGEMENT AND PHYSICAL PLANNING IN POLAND FOR URBANIZED AREAS,
Research Inst. on Environmental Development, Warsaw (Poland).
P. Blaszczyk, and A. Nowakowska-Blaszczyk.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 550-557, 1977. 2 fig, 7 ref.

Descriptors: *Effects, *Urbanization, *Water management(Applied), *Planning, *Poland, Water supply, Decision making, Capital, Investment, Floods, Effluent discharge, Municipal wastes.

Presented are the kinds of physical development plans carried out in Poland and the scope of studies on the systems of water supply and effluent discharge from cities, carried out within the different types of plans. Shown is the significant influence of water economy, including water supply and effluent discharge, upon the formation and development of the settlement network and cities, and indicated are the forms of this influence in urbanized areas. The selection criteria for the most suitable plan alternatives and the influence of the solutions of water supply and effluent discharge systems, together with the effects of floods caused by land urbanization, upon decision making are discussed. The particular importance of water supply and effluent discharge in urbanized areas within the systems of water management and urban technical infrastructure is emphasized from the viewpoint of capital investment designated for water economy (investment outlays for water supply and effluent discharge from cities will comprise 60 per cent of the outlays for each of the above-mentioned systems). (See also W79-07426) (Bell Graf-Cornell)
W79-07486

4D. Watershed Protection

INTENSIVE SITE PREPARATION AND SEDIMENT LOSSES ON STEEP WATERSHEDS IN THE GULF COASTAL PLAIN,
Arkansas Univ. at Monticello. Dept. of Forestry
R. S. Beasley.
Soil Science Society of America Journal, Vol. 43, No. 2, p 412-417, March-April 1979. 2 fig, 4 tab, ref.

Descriptors: *Small watersheds, *Erosion, *On-site investigations, *Mississippi, *Gulf coastal plain, Forest watersheds, Watersheds(Basins), Watershed management, Hydrology, Sedimentation, Runoff, Loblolly pine trees, Pollutants, Sediments, On-site data collections, Channel erosion, Scour, Methodology, Streamflow, Rainfall, Land management, Sediment yield, Runoff, Erosion control, Nonpoint source pollution.

The hydrologic effects of 3 methods of intensive site preparation, brush chopping, shearing and windrowing, and bedding on contour, were measured during the 1976 and 1977 water-years on 3 small watersheds on steep terrain in northern Mississippi

After site preparation, the treated watersheds were fertilized, limed, sown with clover, and planted with loblolly pine seedlings. An undisturbed watershed served as a control. Site preparation exposed soil on 37% of the chopped watershed, on 53% of the sheared and windrowed watershed, and on 69% of the bedded watershed. First-year sediment losses for the chopped, sheared, bedded, and control watersheds were 12.5, 12.8, 14.2, and 0.6 metric tons/ha, respectively. Sediment concentrations for the 4 watersheds were 2,471; 2,837; 2,127 mg/liter of stormflow. Most of the first-year sediment losses occurred during months of highest stormflows, November, January, February, and March. Stream channel scouring was a major source of sediment on the site prepared watersheds. Second-year sediment yields from the chopped, sheared, and bedded watersheds decreased to 2.3, 2.2, and 5.5 metric tons/ha, while sediment from the control watershed decreased to 0.1 tons/ha. Sediment concentrations were 670, 794, 2,346, and 393 mg/liter for the 4 watersheds. In relation to annual precipitation, total stormflow decreased on all treated watersheds the second year. (Humphreys-ISWS)
W79-07140

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

MODEL STUDIES AID POND DESIGN,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W79-07313

A STUDY OF STORMWATER RUNOFF QUALITY,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W79-07321

CROP RESIDUE, SOIL EROSION, AND PLANT NUTRIENT RELATIONSHIPS,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center; and Minnesota Univ., St. Paul. Dept. of Soil Science.
For primary bibliographic entry see Field 2J.
W79-07337

CROP RESIDUE MANAGEMENT FOR WIND EROSION CONTROL IN THE GREAT PLAINS,
Science and Education Administration, Manhattan, KS.
E. L. Skidmore, M. Kumar, and W. E. Larson.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 90-94, March-April 1979. 6 fig, 3 tab, 16 ref.

Descriptors: *Soil erosion, *Great Plains, *Wind erosion, *Erosion control, Land management, Soil conservation, Cultivated lands, Mulching, Grains(Crops), Crops, Barley, Oats, Corn(Field), Sorghum, Soil management, Crop residues.

The authors delineated those croplands in the Great Plains where crop residues might be removed without exposing the soil to wind erosion. On the basis of grain yield data, they estimated the residues produced per unit of land by crops. Also determined were the mean soil erodibility and climatic factors for each of 29 major land resource areas. These factors were used in the wind erosion equation to estimate the residues needed to control wind erosion. The residues produced in excess of those needed for soil conservation depend on the kind and amount of residues, soil erodibility, climate, tillage management, and judgment of erosion and degradation hazard. Better management of these residues would enhance their ability to conserve soil and water and increase soil productivity. Removing residues from fields for other uses should be done judiciously and with an understanding of the consequences. (Humphreys-ISWS)
W79-07339

TILLAGE AND PLANT RESIDUE MANAGEMENT FOR WATER EROSION CONTROL ON AGRICULTURAL LAND IN EASTERN OREGON,
Science and Education Administration, Pendleton, OR. Columbia Plateau Conservation Research Center.
R. R. Allmaras, S. C. Gupta, J. L. Pikul, and C. E. Johnson.
Journal of Soil and Water conservation, Vol. 34, No. 2, p 85-90, March-April 1979. 1 fig, 7 tab, 14 ref.

Descriptors: *Erosion control, *Soil conservation, *Farm management, *Oregon, Crops, Wheat, Fallowing, Effects, Soils, Slopes, Rainfall, Erosion, Contour farming, *Tillage practices, *Crop residue, Soil loss, Residue removal, Residue production.

The authors estimated soil erosion by water in the major land resource areas (B7, B8, B9) of eastern Oregon. Combinations of tillage and crop residue handling, terracing, and contouring were evaluated as control alternatives. Wheat-fallow, especially, and wheat-pea sequences predominated. Soil erosion exceeded tolerance limits in the wheat-fallow sequence on slopes over 20% even with all 3 management inputs. All 3 management inputs were needed on slopes between 12 and 20%. Tillage and residue management, along with contouring, sufficed on slopes less than 12%. The 3 major land resource areas in eastern Oregon (1.94 million hectares) produce 1.3 million metric tons of small grain residues annually, 60% of which can be harvested from 88% of the 344,200 hectares harvested. (Sims-ISWS)
W79-07340

CROP RESIDUE REQUIREMENTS FOR WATER EROSION CONTROL IN SIX SOUTHERN STATES,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
R. B. Campbell, T. A. Matheny, P. G. Hunt, and S. C. Gupta.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 83-85, March-April 1979. 4 fig, 1 tab, 9 ref.

Descriptors: *Erosion control, *Alabama, *Mississippi, *Soil conservation, *Soil erosion, *Farm management, *Southeast U.S., Erosion, Crops, Corn, Soybeans, Grains(Crops), Cotton, Sorghum, Effects, Soils, Rainfall, Agriculture, *Tillage practices, *Crop residue, Residue production, Residue removal, Soil loss.

The authors calculated the crop residues needed for water erosion control in 6 southern states. Six crop sequences were evaluated in each of 14 major land resource areas (MLRA). In 13 of 14 MLRAs, weighted average estimated soil loss exceeded tolerable limits. The exception was MLRA 153, Atlantic Coastal Flatwoods, where the greatest percentage of residues remains available after water erosion control needs are met. In 4 of 6 states, 6 million metric tons (6.6 million tons), or 60% of crop residues, are needed for water erosion control. The remaining 40% is available for other uses. In Alabama and Mississippi about 90% of the residues produced are needed for water erosion control. (Sims-ISWS)
W79-07341

TILLAGE AND CROP RESIDUE EFFECTS ON SOIL EROSION IN THE CORN BELT,
Science and Education Administration, Morris, MN.
M. J. Lindstrom, S. C. Gupta, C. A. Onstad, W. E. Larson, and R. F. Holt.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 80-82, March-April 1979. 3 fig, 3 tab, 6 ref.

Descriptors: *Erosion control, *Soil erosion, *Farm management, *Soil conservation, *Corn Belt, Erosion, Crops, Effects, Corn(Field), Soybeans, Grains(Crops), Soils, Rainfall, Agriculture, *Tillage practices, *Crop residue, Residue production, Residue removal, Soil loss.

Potential soil erosion by water was calculated for major land resource areas (MLRAs) in the Corn Belt using the universal soil loss equation and current cropping practices. Annual erosion rates ranged from 44.7 metric tons per hectare (19.9 t/a) in MLRA 107 to 9.7 metric tons per hectare (4.3 t/a) in MLRA 103 for a conventional fall-plow, spring-disk tillage system with all residues removed. With no conservation practices applied, only 36% of the cultivated area in the Corn Belt would have a soil erosion rate less than or equal to the allowable limits established by the Soil Conservation Service. Use of tillage and residue management systems increases this area to 78%. When soil erosion is the only restraint, the maximum amount of residues that can be removed from cropland in the Corn Belt is 58% of the total produced. Most of this is located in 4 of the 14 MLRAs. However, variations in residue production and the erosion index within MLRAs pose serious limitations to removal of large amounts of residues for other uses. (Sims-ISWS)
W79-07342

PREDICTING THE EFFECTS OF TILLAGE AND CROP RESIDUE MANAGEMENT ON SOIL EROSION,
Science and Education Admin., St. Paul, MN.
S. C. Gupta, C. A. Onstad, and W. E. Larson.
Journal of Soil and Water Conservation, Vol. 34, No. 2, p 77-79, March-April 1979. 3 fig, 4 tab, 14 ref.

Descriptors: *Erosion control, *Soil erosion, *Farm management, Crops, Effects, Erosion, Corn(Field), Soybeans, Grains(Crops), Soils, Slopes, Rainfall, Agriculture, Soil conservation, *Tillage practices, *Crop residue, Residue production, Residue removal, Soil loss, Erodibility, Row crops.

Using the universal soil loss equation, those areas were delineated from which crop residues could be removed from the soil surface for other uses without erosion exceeding the soil loss tolerance limit. The amount of crop residues produced were calculated and the amounts available for removal were determined. The sources of data and computation procedures used in this study were presented and the kind of information available from the computer analysis was illustrated. (Sims-ISWS)
W79-07343

REDUCTION OF SOIL EROSION BY THE NO-TILL SYSTEM IN THE SOUTHERN PIEDMONT,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
G. W. Langdale, A. P. Barnett, R. A. Leonard, and W. G. Fleming.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 1, p 82-86, 92, January-February 1979. 6 fig, 3 tab, 17 ref.

Descriptors: *Soil erosion, *Farm management, *On-site investigations, Crops, Runoff, Precipitation(Atmospheric), Rainfall, Sediments, Barley, Sorghum, Soybeans, Erosion, Erosion control, Agriculture, *Tillage practices.

Soil erosion control of row-cropped, Southern Piedmont lands is a constant problem. A 2.71 ha watershed, with an average slope of 3.4%, was

equipped with a 0.76 m H-flume in summer of 1972 to study runoff and soil losses from row crop land. The watershed treatments were conventional till, without terraces or grassed waterways, during the first 2 yr in a soybean-fallow sequence, and then 2 yr of no-till double cropped barley, followed by grain sorghum with a fescue grassed waterway. Annual runoff was decreased from 22.5 cm (17.6%) with conventional tillage to 12.0 cm (9.7%) with double cropped, no-till practices. Runoff was reduced 90% during the vulnerable sediment and chemical transport season of May, June, and July. Annual flume-measured sediment decreased from 26.26 t (metric tons)/ha (11.71 tons/acre) with conventional tillage to 0.13 t/ha (0.06 ton/acre) with no-tillage. Soil loss values associated with no-tillage showed that crop row direction is not important when no-tilling is accompanied with grassed waterways in the Southern Piedmont. Barley and grain sorghum both produced 15.43% t/ha (6.88 tons/acre) of grain during the no-till period. Annual erosion, estimated by the Wischmeier-Smith erosion equation, was 71.23 t/ha (31.80 tons/acre) and 1.30 t/ha (0.58 ton/acre) for conventional and no-till, respectively. (Sims-ISWS)
W79-07438

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EFFLUENT WATER QUALITY DISCHARGED FROM THREE OYSTER SHELLSTOCK WASHERS,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
F. W. Wheaton, S. C. Chang, and A. L. Ingling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 463, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, Maryland University, Completion Technical Report No. 54, April 1979. 104 p, 18 fig, 28 tab, 8 ref, 1 append. OWRT A-033 MD(3).

Descriptors: *Waste water, *Effluents, *Oysters, *Cleaning, Equations, Liquid wastes, Biochemical oxygen demand, Chemical oxygen demand, Solids, Suspended solids, Phosphates, Nitrogen compounds, Waste identification, Water analysis, Shellfish, Water quality standards.

To determine the most desirable method of washing oyster shellstock, three different washing devices were evaluated. The cleaning efficiency, water requirements and discharge water quality of a spray washer, a brush washer and a tumbler washer were compared. Regression equations were developed to predict the ratio of foreign material removed from a bushel of oysters run at various washer settings to the weight of foreign material removed from a bushel of oysters run at a standard setting of the brush and spray washers. Tests with the tumbler washer were terminated before a regression analysis could be made, because the tumbler washer severly damaged the oysters. An analysis of the effluent water quality showed that Kjehdahl nitrogen, orthophosphate, hydrolyzable phosphate and total phosphates, residual chlorine and chloride concentrations were too low to present problems in meeting waste water discharge regulations. Tests for BOD5, COD and suspended, filterable, and settleable solids indicate that some treatment will be necessary for solids removal from the washer effluent. The washer effluent pH averaged about 8.1 to 8.2, which was within the 6 to 9 range permitted by discharge regulations. Standard plate count often exceeding 300,000 MPN/100 ml and total coliform ranging from 59 to over 1,600 MPN/100 ml were too high for direct discharge. (Davison-IPA)
W79-07003

RECOVERY OF VIRUSES FROM THE MISSOURI RIVER,
Environmental Protection Agency Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W79-07031

THE ALSTERBERG (AZID) MODIFICATION OF THE WINKLER METHOD FOR THE DETERMINATION OF THE BOD OF INCINERATOR QUENCH WATER AND THE CALIBRATION OF THE WESTON AND STACK DO ANALYZER MODEL 300-B,
Bureau of Solid Waste Management, Cincinnati, OH.
D. L. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 953, Price codes: A03 in paper copy, A01 in microfiche. Report 1970. 39 p, 1 tab, 5 ref.

Descriptors: *Biochemical oxygen demand, *Incineration, *Quenching, *Analytical techniques, *Pollutant identification, Water analysis, Standards, Laboratory tests.

The Alsterberg (Azide) Modification of the Winkler Method utilizing dilution water is employed to standardize the Weston and Stack DO Analyzer and to determine the BOD of incinerator quench water. Preliminary tests are presented which evaluate the applicability of the Alsterberg (Azide) Modification in the determination of BOD. The test can not be employed if the diluted sample contains more than 4 ppm nitrate, or 1 ppm ferrous iron or 200 ppm ferric iron, or any sulfite or thiosulfate, or large amounts of chloride. Standards must be employed to verify the validity of the preliminary analyses and reveal to the analyst knowledge of the color intensity and hue. The principle of the test, apparatus, reagents, standardization, and sample analyses are presented. Since the tests are not specific and give a positive reaction in the presence of several substances, the tests are assigned group numbers. The sample analyses presented are for eight groups, one group for each of the interfering substances. (Small-FRC)
W79-07034

DEVELOPMENT OF A CHEMILUMINESCENT AND BIOLUMINESCENT SYSTEM FOR THE DETECTION OF BACTERIA IN WASTEWATER EFFLUENT,
Boeing Co., Houston, TX.
R. R. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-23824, Price codes: A03 in paper copy, A01 in microfiche. Report NASA-CR-144750, 1975. 48 p, 12 fig, 6 tab, 9 ref, 2 append.

Descriptors: *Bioluminescence, *Monitoring, *Chemical analysis, *Sewage bacteria, *Chemical reactions, Analytical techniques, Catalysts, Light intensity, Light quality, Pollutant identification, Waste water, Effluent streams.

Automated chemiluminescent and bioluminescent sensors were developed for continuous monitoring of bacteria in waste water effluent. In the chemiluminescent system, the optimum reagent concentrations were identified as 0.00025 M luminol, and 0.0125 M sodium perborate in 0.75N sodium hydroxide prior to addition of the sample. New techniques developed for increased sensitivity and specificity included extraction of porphyrins from bacteria collected in a filter using 0.1N NaOH-50% ethanol, and the use of the specific reaction rates for different luminol catalysts. Because the reaction times are different for each catalyst, a specified reaction for bacteria can be achieved by measuring only the light emission fromthe particular reaction time zone specific for bacteria. Flow system design modifications were developed for the bioluminescent firefly luciferase system. (Lisk-FRC)
W79-07064

DISSOLVED OXYGEN MODEL OF A SHORT DETENTION TIME RESERVOIR WITH ANAEROBIC HYPOLIMNION,
Iowa Univ., Iowa City. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 2H.
W79-07121

DETERMINATION OF ACID-BASE AND SOLUBILITY BEHAVIOR OF LIGNITE FLY ASH BY SELECTIVE DISSOLUTION IN MINERAL ACIDS,
Missouri Univ.-Columbia. Dept. of Chemistry.
J. B. Green, and S. E. Manahan.
Analytical Chemistry, Vol. 50, No. 14, p 1975-1980, December 1978. 2 fig, 4 tab, 25 ref. OWRT A-106-MO(3). 14-34-001-8027.

Descriptors: *Fly ash, Acids, Titration, Trace elements, Lignite.

A method has been developed for the chemical analysis of fly ash which gives the total available base in the ash. This method is based upon the dissolution of fly ash in mineral acid accompanied by analysis of major metal ion constituents and sulfate. The amount of base obtained from fly ash through direct reaction with acids is much greater than that obtained from dissolution in pure water, a fact of significance in the chemical utilization of fly ash. Fly ash dissolves in discrete steps with increasing acidity, thereby indicating the presence of specific fractions within the material.
W79-07127

OBSERVATIONS ON THE GEOCHEMISTRY OF SOLUBLE COPPER, IRON, NICKEL, AND ZINC IN THE SAN FRANCISCO BAY ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton.
Environmental Science and Technology, Vol. 13, No. 4, p 425-432, April 1979. 5 fig, 6 tab, 47 ref. Dep. Energy EY-76-S-02-3292.

Descriptors: *Metals, *Estuaries, *Water pollution, *California, Pollutants, Path of pollutants, Trace elements, Bays, Copper, Iron, Nickel, Zinc, Sampling, Chemical analysis, Water chemistry, Regression analysis, Water quality, *San Francisco Bay.

At discharges of 300-400 cu m/s, surface waters of the San Francisco Bay estuary contain dissolved Cu and Ni at levels of 1 to 4 ppb. This is approximately an order of magnitude higher than waters outside the Bay. Zn concentrations are 2-6 ppb within the estuary and generally less than 1 ppb outside. Cd concentrations are 0.08 to 0.2 ppb within the estuary and 0.05 to 0.11 ppb outside. The behavior of all these elements is probably dominated by physical processes during most seasons, although Cu shows evidence for removal during summer months when river flow is low. Cu, Ni, and Zn show an excess of about 1 ppb relative to conservative mixing in the more saline portion of the estuary. This excess was attributed to municipal and industrial discharges. (Sims-ISWS)
W79-07144

RESPONSE OF HALEY POND, MAINE, TO CHANGES IN EFFLUENT LOADS,
Maine Dept. of Environmental Protection, Augusta.
For primary bibliographic entry see Field 5D.
W79-07147

HERBICIDE RUNOFF FROM UPLAND PIEDMONT WATERSHEDS--DATA AND IMPLICATIONS FOR MODELING PESTICIDE TRANSPORT,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
R. A. Leonard, G. W. Langdale, and W. G. Fleming.
Journal of Environmental Quality, Vol. 8, No. 2, p 223-229, April-June 1979. 5 fig, 5 tab, 23 ref.

Descriptors: *Herbicides, *Pesticides, *Runoff, *Water quality, On-site investigations, Model studies, Mathematical models, Rainfall, Crops, Sediments, Soils, Pollutants, Path of pollutants, Agri-

cultural chemicals, Paraquat, Atrazine, Diphenamid, Cyanazine, Propazine, Trifluralin.

Runoff and persistence of selected herbicides were studied on 4 small Piedmont watersheds in Georgia during 4 growing seasons. This was part of a study designed to provide data for developing and testing mathematical models for agricultural chemical transport. Seasonal runoff losses were determined relative to watershed management, herbicide type and persistence, mode of application, and time of runoff in relation to application timing. Seasonal losses were usually less than 2% of the application, unless large runoff volumes were generated shortly after application. Average storm herbicide concentrations in runoff were correlated with herbicide concentrations at the 0- to 1-cm depth increment of the watershed soils at the time of runoff. Paraquat concentrations in runoff (predominantly sediment associated) were well correlated and positive with the product of soil herbicide concentration and sediment in runoff. Equations describing soil-based herbicide transfer to runoff were power functions with exponents near unity with the form: $Y = a x$ to the b power. Simple relationships such as those developed in this study along with hydrology and erosion/sediment models may be useful in predicting pesticide runoff potential when assessing relative impacts of management decisions. The next step would be to describe key management practices in terms of these coefficients and exponents. (Sims-ISWS)
W79-07154

RUNOFF WATER QUALITY AS AFFECTED BY SURFACE-APPLIED DAIRY CATTLE MANURE,
Science and Education Administration, Auburn, AL.
For primary bibliographic entry see Field 5B.
W79-07155

TRACE ELEMENTS IN FLY ASH AND THEIR RELEASE IN WATER AND TREATED SOILS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. T. Phung, L. J. Lund, A. L. Page, and G. R. Bradford.
Journal of Environmental Quality, Vol. 8, No. 2, p 171-175, April-June 1979. 3 fig, 4 tab, 22 ref.

Descriptors: *Fly ash, *Trace elements, *Soils, Laboratory tests, Chemicals, Heavy metals, Powerplants, Coal, Wastes, Waste disposal, Pollutants, Path of pollutants, Water pollution, Soil water, Hydrogen ion concentration, Acids, Alkalinity.

Fly ash from a coal-fired power plant was separated into various-sized fractions which were then chemically characterized. The fly ash contained higher concentrations of B, Co, Cr, Cd, Mo, Ni, Pb, As, and Se than normally found in soils. Except for Cd, Co, and Pb, trace elements were more concentrated in the less than 53 micrometers than in the greater than 250 micrometers fraction. Solubility of trace elements in water increased greatly as the equilibrium pH was lowered. Three soils, an acid sand, a calcareous loamy sand, and a calcareous silt loam, were amended with 5 rates of fly ash up to 1% by weight and equilibrated at moisture contents of 1/3 bar or saturation for periods ranging up to 29 weeks. Solubility of trace elements in water and DTPA extracts was observed. Application of fly ash increased soil pH; the acid soil exhibited the greatest increase. Except for B, fly ash amendment up to 1% did not result in elevated concentration of either water-soluble or DTPA-extractable trace elements. Additions of fly ash to the acid soil decreased DTPA-extractable Fe, Mn, Ni, Co, and Pb. The data demonstrated that the alkalinity of fly ash plays a significant role in regulating the availability of trace elements in the amended soils. (Sims-ISWS)
W79-07159

HEAVY METALS PARTITIONING IN A STREAM RECEIVING URBAN RUNOFF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. D. Lorenz. Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 725, Price codes: A09 in paper copy, A01 in microfiche. M.S. Thesis, May, 1978. 196 p, 58 fig, 49 tab, 94 ref. OWRT B-103-VA (1).

Descriptors: *Urban runoff, *Heavy metals, Stormwater drainage, Sewage effluent, Spectrophotometry, Land use, Nonpoint pollution.

Water, sediment detritus, caddisflies, snails, and crayfish were collected from Bull Run, July 31-Oct. 2, 1977 and analyzed for Fe, Mn, Ni, Pb, Cd, Zn, Cr, and Cu by atomic absorption spectrophotometry after digestion and extraction procedures. Samples were collected from six sampling stations which received sewage effluent, urban runoff, and stormwater drainage from the Manassas, Virginia, area. Concentrations of Pb and Cu in water, sediment, detritus, and caddisflies increased with increasing distance downstream and were significantly (0.95 level) greater in these components immediately below the stormwater input than at the upstream control. Concentrations of Pb in sediment collected at a downstream station were significantly greater than those at the control station even though the control sediment characteristics favored metal retention more than the downstream sediment characteristics. Mean Cu concentrations in sediments at this station were greater than at the upstream control station while all other metals were concentrated the least in sediment at the downstream station. Significant (0.95 and 0.99 level) linear correlation coefficients among a majority of stream components were found for Pb and Cu. It appears that urban runoff and stormwater drainage contributed sufficient quantities of Pb and Cu into Bull Run such that these metals accumulated greater in stream components below the Manassas urban area.
W79-07166

THE INVERTIBRATE FAUNA AND BIOTIC INDEX VALUE OF WATER QUALITY OF THE GREAT BERG RIVER, WESTERN CAPE,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
A. Coetzer.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 1-7, July 1978. 2 tab, 9 ref.

Descriptors: *Water pollution, *Pollutant identification, *Benthic fauna, *Great Berg River(Western Cape Southern Africa), Bioindicators, Sampling, Bottom sampling, Water analysis, Water quality, Water pollution effects, Annelids, Equipment, Nets, Analytical techniques.

Invertebrate fauna samples were taken at seven locations along the main stream of the Berg River at three different periods during 1974, and analyzed to assess the condition of the river. In addition to ascertaining changes in riverine fauna occurring since 1952, this study was designed to determine whether the biological index method modified by Chutter is applicable to conditions in the Western Cape. The river habitat at all sampling localities is described. The benthic organisms collected are tabulated for comparison with a 1958 survey. Results of this comparison indicate increased pollution. The 1958 survey revealed that mild pollution favored Orthocladiinae, Chironominae, Baetis harrisoni and Nais spp. and that taxa typical of the upper zones disappear entirely under conditions of mild pollution. Orthicladinae were present at all locations except two during the present survey. Annelids increased at the location with low aeration and impaired purity, a definite indication of pollution. Of the total fauna sampled, a greater percentage were found to be pollution favoring organisms in the present survey than were found in an earlier survey. It is concluded that the Chutter method satisfactorily indicated the pollution status of the Berg River. (Davison-IPA)
W79-07182

THE EFFECT OF TEMPERATURE ON SPECIFIC GROWTH RATE AND ACTIVATION ENERGY OF MICROCYSTIS AND SYNECHOCOCCUS ISOLATES RELEVANT TO THE ONSET OF NATURAL BLOOMS,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
G. H. J. Kurger, and J. N. Eloff.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 9-20, July 1978. 12 fig, 4 tab, 28 ref.

Descriptors: *Algae, *Growth rates, *Temperature, *Activation energy, *Eutrophication sources, Laboratory tests, Laboratory equipment, Cultures, Light intensity, Light penetration, Impoundments.

The effect of temperature on the growth of two toxic and two non-toxic Microcystis was investigated to determine the correlation between temperature and appearance of Microcystis blooms in nature. The Microcystis lower temperature limit varied between 10.5 and 13.5C, thermal growth optimum varied between 28.8 and 30.5C, and the upper temperature limit varied between 35.0 and 40.0C. The corresponding values for Synechococcus were 10.3, 34.5, and 44.3C. Saturating light intensities could not be used because the construction of the apparatus did not permit the cultures to remain stationary. The lower temperature limit, thermal growth optimum, and the upper temperature limit were influenced by increasing the light intensity. Arrhenius equations and Q10 values were calculated, and activation energies were calculated for the different isolates from the respective Arrhenius plots. The temperature value for the onset of natural blooms of Microcystis coincided with an inflection in the gradient of the Arrhenius plot, indicating a sudden decrease in activation energy and an increase in Q10 above 17.5C. Useful predictions of specific growth rates under natural conditions may be possible through the use of Arrhenius equations such as those computed in this study. (Davison-IPA)
W79-07183

THE FRACTIONATION OF CLAY SIZED PARTICLES FROM THE WURAS DAM WATER PHASE,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
A. J. H. Pieterse.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 77-79, July 1978. 2 tab, 9 ref.

Descriptors: *Impounded waters, *Suspended solids, *Clays, *Turbidity, *Separation techniques, Dams, Wuras Dam(South Africa), Water pollution sources, Water quality, Water quality control, Coulter Counter, Particle size.

The Coulter Counter, successfully used to estimate the number and sizes of suspended particles in sea water, was applied to Wuras Dam, a turbid man made lake in South Africa. Larger sized clay particles occur in high concentrations in the inflow water and in the water of the dam proper. Fractionation of particles between ca 1 and 2 micromillimeters in diameter have been achieved; a higher concentration of small sized particles occurred in the dam water while concentration of the larger particles was lower. Estimates of the surface area were made for each size fraction. Considerable surface areas were associated with the various particle size fractions. Due to a higher concentration of the 1.09 micromillimeter particle fraction, the total surface area of the coarse clay sized particles of the water at the dam wall was greater than that of the inflowing water. Assuming these estimates represent a close approximation of the surface areas present in this water, and that the surfaces are an important limnological feature, it is possible that many conditions and processes in Wuras Dam are most likely governed by the suspended particles. (Davison-IPA)
W79-07190

USING YOUR COMPUTER TO FILE WELL LOGS,
R. B. McDannald.
Water Well Journal, Vol. 33, No. 6, p 30-31, June,

1979. 3 fig.

Descriptors: *Computer programs, *Well data, *Drillers logs, Data collections, Water wells, Data processing, Data storage and retrieval.

The operation of a simple well log computer program is explained. The program has three routines: file creation, file sort, and file search. Data required for the file creation routine are: township name and section, street name and number, customer name, well diameter, depth, pump depth, bedrock depth, static level, drawdown, gpm, core type, log number, and date. In the file sort routine the computer sorts out all the logs for a particular township and records them on a data cassette tape which can then be used in the file search routine to locate a particular well log in that township. (Purdin-NWWA)
W79-07195

MICROBIOLOGICAL CHARACTERISTICS OF URBAN STORM WATER RUNOFFS IN CENTRAL ONTARIO.
Ontario Ministry of the Environment, Toronto (Ontario).
Research Report No. 87, 1978, 130 p, 17 fig, 17 tab, 82 ref, 6 append. 75-3-24, 74-8-25, 76-8-41.

Descriptors: *Storm water, *Runoff, *Bacteria, Pollution, Viruses, Salmonella, Human diseases, Sampling, Rainfall, Infiltration, *Ontario, Fecal coliforms, Fecal sterols.

This volume contains three reports: (1) Microbiological Study of Some Canadian Storm Water Runoffs at Burlington and Brucewood, by Dutka, B. J., and Rybakowski, I., is a six-month study (June-November, 1975) to investigate the microbiological composition of storm water runoffs in Burlington, Ontario, and Brucewood (Toronto): (2) Microbiological Characteristics of Storm Water Runoffs at East York (Toronto) and Guelph Separate Storm Sewers, by Qureshi, A. A., is a six-month study to determine the microbiological characteristics of storm water runoffs at East York (Toronto) and Guelph separate storm sewers, and, (3) Monitoring of Storm Water Runoffs for Bacterial and Viral Pathogens of Man, by Dutka, B. J., and Tobin, S., is an eight-month project (April-November, 1976) to study the distribution of bacterial pathogens and viruses in storm water runoffs at the Malvern storm sewer outfall in central Burlington. (WATDOC)
W79-07213

A SIMPLE FLOATING MEAN CONCENTRATION SAMPLER,
Canada Centre for Inland Waters, Burlington (Ontario).
K. C. Miners.
Technical Bulletin No. 108 1978. 4 p, 12 fig.

Descriptors: *Water, *Lakes, *Sampling, *Floating, Effluents, Average, Design, Construction, Installation, *Concentration sampler, *Operating principle.

The requirement for an inexpensive reliable means of collecting time-integrated, near surface water samples at numerous stations around a point-source effluent, led to the development of an unpowered, moored sampler which could be deployed, serviced, and recovered by hand from a small boat. The sampler consists of a container held at a fixed depth on a ballasted spar. The interior of the container is vented to the atmosphere, and open to the ambient water mass via a nozzle assembly protected by a fine mesh filter. The pressure differential across the nozzle is sufficient to maintain a very small but constant flow into the container, such that sampling periods greater than twelve hours are achieved. By observing the assembly and operational precautions outlined in the text, the configuration described will operate reliably for at least several weeks. (WATDOC)
W79-07217

WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07239

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07241

FLUOROMETRIC STUDIES ON THE TOXINS OF GONYAULAX TAMARENSIS AND APHANIZOMENON FLOS-AQUAE,
New Hampshire Univ., Durham. Dept. of Biochemistry.
N. H. Shoptaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 723, Price codes: A10 in paper copy, A01 in microfiche. Doctor of Philosophy Thesis, 1978. 199 p, 36 fig, 25 tab, 133 ref, 2 append. OWRT A-047-NH(1). 14-34-0001-7062.

Descriptors: *Shellfish, *Toxins *Fluorometry, Algal toxins, Colorimetry, Crabs, Mussels, Clams, Aquatic life, Bioassay, Pigments, Saxitoxin, *Blue-green alga.

The major objective was to develop a rapid, sensitive method for determining shellfish toxin content in clams, Mya arenaria, and mussels, Mytilus edulis, and to devise methods applicable for toxin detection in A. flos-aquae and in crabs, Cancer irroratus. Fluorometric techniques for detection of saxitoxin (STX) on thin-layer chromatography were shown to be more specific and 100 times more sensitive than many of the guanidine colorimetric reactions on thin-layer chromatography. The oxidation of STX with alkaline hydrogen peroxide followed by acidification produced a solution fluorophor with an excitation of 332 nm and an emission of 381 nm. The solution fluorometric assay quantitated as little as 0.005 to 0.01 micrograms STX. Reaction pH, temperature, time, and hydrogen peroxide concentration, as well as exposure to external light and various ions, purines, and proteins had an effect on the fluorescence intensity of the STX fluorophor. The alkaline hydrogen peroxide oxidation of A. flos-aquae extracts produced a fluorophor with 330 nm excitation and 380 nm emission maxima. The temperature-time profile of the Aphanizomenon fluorophor indicated that it showed a greater temperature sensitivity than the STX fluorophor. The pigmentation present in the solution fluorometric assay produced varied results that did not correlate consistently with the mouse bioassay. The Aphanizomenon toxin fluorophor applied to and eluted from the strong cation exchange column showed a behavior similar to the STX fluorophor. The application of the column fluorometric procedure to the quantitation of Aphanizomenon toxin yielded values comparable to the mouse bioassay using a STX standard.
W79-07254

NON-POINT POLLUTION AND ALASKA,
For primary bibliographic entry see Field 6E.
W79-07269

LOW-MOLECULAR-WEIGHT HYDROCARBON AND HYDROGRAPHIC PROJECT,
Texas A and M Univ., College Station. Dept. of Oceanography.
W. M. Sackett, J. M. Brooks, B. B. Bernard, and C. R. Schwab.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 3-1 - 3-128, January 15, 1979. 52 fig, 25 tab, 56 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Hydrography, *Water pollution sources, *Seepage, Environmental effects, Texas, Methane, Propene, Resources development, Texas, *Outer Continental Shelf, *Hydrocarbons, Petroleum development, Ethene, South Texas Outer Continental Shelf(STOCS).

A comprehensive tabulation and analysis of all low-molecular-weight hydrocarbon (LMWH), dissolved oxygen, and nutrient data taken as part of the BLM South Texas Outer Continental Shelf (STOCS) program in 1977 is presented. Methane showed considerable variation in the STOCS area waters. Near-bottom seepage was detected in bottom waters at some stations. Ethene and propene showed the same general trend as productivity; low surface values were observed in the winter with higher values in the spring, summer and fall. Ethene generally showed a maximum at some shallow depths (20 to 40 m) in the water column. The olefins generally dominated over their saturated analogs in the STOCS area. The lower Texas shelf is relatively 'clean', as most of the light hydrocarbons on this shelf are presently derived from natural sources. Oxygen values are controlled throughout most of the year in the upper 50 to 70 m of the STOCS area by physical processes. Nutrient concentrations were typically low, being representative of open Gulf surface water. Nitrate was limiting to productivity and disappeared during the summer and early fall. Phosphate and silicate were affected by the spring increase in productivity but were generally regenerated by fall. Increased continental runoff during the spring months was reflected by high silicate values at nearshore stations. (See also W79-07287) (Sinha-OEIS)
W79-07290

THE SIGNIFICANCE OF SEWAGE EFFLUENT FOR THE HYDRAULIC AND NUTRIENT LOADS ON LAKES,
National Swedish Environmental Protection Board, Uppsala (Sweden). Inst. of Physiological Botany.
For primary bibliographic entry see Field 5B.
W79-07319

A STUDY OF STORMWATER RUNOFF QUALITY,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
W. G. Characklis, P. B. Bedient, F. G. Gaudet, and F. L. Roe.
Progress in Water Technology, Vol. 10, No. 6, p 673-699, 1978. 11 fig, 8 tab, 9 ref.

Descriptors: *Storm runoff, *Texas, *Water quality, *Cities, *Urban runoff, Pollutants, Pollutant identification, Runoff, Sampling, Suspended solids, Sediments, Chemicals, Nutrients, Chemical oxygen demand, Carbon, Nitrogen, Phosphorus, Dissolved oxygen, Chlorinated hydrocarbon pesticides, Bacteria, Sediment control, Water pollution, *Houston(TX).

The stormwater from 4 watersheds in the Houston area was monitored by an intensive sampling and analytical program over a 3 year period. The land use in the watersheds included undeveloped forest, developing forest, fully developed residential, and mixed commercial-residential. Chemical parameters monitored included suspended solids, oxygen demand, organic carbon, nitrogen, phosphorous, dissolved oxygen, pH, specific conductance, and chlorinated hydrocarbons. Indicator and pathogenic bacterial content were enumerated as well as aquatic and edaphic algae species. Disinfectant demand and algal bioassays were also conducted. Relationships were developed between stormwater runoff quality, quantity, and land use in an effort to predict pollutant loads. The appearance of a 'first flush' was dependent on the parameter measured and the watershed characteristics. Rainwater quality contributes significantly to stormwater pollutant load, especially in urbanized areas. The modifying effect of natural biological processes on nitrogen content in the runoff and the effects of the hydrological regime on nutrient limitations were observed. The effectiveness of storage lakes, very positive in the case of suspended solids, was described. (Sims-ISWS)
W79-07321

SOURCES AND CONCENTRATIONS OF NITRATE-NITROGEN IN GROUND WATER OF THE CENTRAL PLATTE REGION, NEBRASKA,
Nebraska Univ., Lincoln. Div. of Conservation and Survey.
For primary bibliographic entry see Field 5B.
W79-07322

SOURCES AND MOVEMENT OF ORGANIC CHEMICALS IN THE DELAWARE RIVER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W79-07331

AN EVALUATION OF NON-SPECIFIC MEASUREMENTS ON ORGANIC POLLUTANTS IN WATERS AND WASTEWATER,
Victoria State Rivers and Water Supply Commission, Victoria (Australia).
T. D. Waite.
Australian Water Resources Council Technical Paper No. 34, 1978. 171 p, 59 fig, 34 tab, 195 ref, 5 append. 74/66.

Descriptors: *Pollutant identification, *Water pollution, *Organic wastes, *Decomposing organic matter, *Chemical wastes, *Biochemical oxygen demand, Analytical techniques, Mathematical models, Water pollution control, Water analysis, Laboratory tests, Water chemistry.

To facilitate decisions in setting standards for organics in Australian water, a study with the following objectives was undertaken: (1) to investigate the usefulness of the biochemical oxygen demand (BOD) test; (2) to study other established methods for measuring the organic content of waters and compare them with the BOD test; and (3) to investigate other non-specific analytical techniques which may assist in explaining the nature and quality of organics in waters. The relationships between the various techniques used to measure organic concentration in waters are discussed, and data and results from literature regarding organic carbon-oxygen demand correlation are reviewed. Methods for measuring biodegradable and non-biodegradable organics in water and the potential role of organic carbon measurements in water pollution control are examined. An interpretation of BOD kinetics is presented. Results of experiments relating analytical techniques responses to the degredation of raw sewage samples are discussed stressing the effect of the changing ratio of biodegradable organics to refactory organics. The interpretation of these results involves mathematical modeling of oxygen uptake and substrate removal curves. It is concluded that although several tests are available to indicate the magnitude of organic contamination of waters, the BOD5 test is still used by many authorities as the major indicator of organic pollution. (Davison-IPA)
W79-07347

APPARATUS AND METHOD FOR ANALYZING OIL CONTENT OF WATER,
Delray Electronics Inc., Westville, NJ. (Assignee).
F. Malley, and R. F. Akers.
U.S. Patent No. 4,137,494, 6 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1859, January 30, 1979.

Descriptors: *Patents, *Pollutant identification, *Water pollution, *Oil pollution, Organic wastes, Oily water, Electronic equipment, Electrodes, Ion transport.

The object of this invention is to provide a small and rugged detection device which is adapted to detect trace amounts of organic molecules in water, and which is adapted to operate efficiently and reliably at the site of the water which is to be tested. An oil content analyzer device contains a degradable ion transport cell designed to present a changing internal impedance as a function of the oil content of water flowing through it. The cell is comprised of two electrodes made of dissimilar metallic compositions with a hydrocarbon-absorbing material sandwiched between, and housed in a container having openings to permit the water to flow through. In operation, a sample of water is circulated through the device with the result that the electrical output characteristics of the device change as a function of the amount of hydrocarbons absorbed in the membrane element and an electrical signal is generated which is inversely proportional to the oil content of the analyzed water sample. (Sinha-OEIS)
W79-07418

SOME QUALITATIVE AND QUANTITATIVE ASPECTS OF SURFACE WATER IN AN URBAN AREA WITH SEPARATE STORM WATER AND WASTE WATER SEWER SYSTEMS,
Rijksdienst voor de Ijesselmeerpolders, Lelystad (Netherlands).
For primary bibliographic entry see Field 2A.
W79-07441

MICROSUBSTANCES IN URBAN STORM WATER,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
B. Horkeby, and P-A. Malmquist.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 252-264, 1977. 8 tab, 17 ref.

Descriptors: *Microsubstances, *Effects, *Water quality, *Chemical analysis, *Storm water, *Goteborg(Sweden), Waste water(Pollution), Heavy metals, Organic compounds, Sludge, Drinking water, Standards, Concentrations, Sampling, Receiving waters, Atmospheric fallout.

During 1976 a catchment in Goteborg was investigated with respect to microsubstances in storm water and atmospheric fallout. The microsubstances studied were 17 heavy metals and PCB, DDT with derivatives, HCB and PAH. The concentrations of heavy metals in storm water were not remarkably high compared with those in waste water and sometimes in drinking water. For As, Cd, Cr, Hg, Sb, V, and Pb, atmospheric fallout could explain a great deal of the metal content in the storm water. For the other metals, only a smaller fraction could be explained by atmospheric fallout. Most of the heavy metals originate from traffic and from corrosion. The concentrations of PCB, DDT, and HCB were relatively low compared to results of earlier investigations of dustfall. The concentration of PAH in the storm water was high (10-320 micrograms of naftalene-equivalents/l unfiltered sample), on one occasion even higher than in waste water. Most of the PAH was found to be attached to particles. Applications of the different microsubstances and their effects on man, flora, and aquatic fauna are given. (See also W79-07426) (Bell Graf-Cornell)
W79-07453

QUALITY OF COMBINED SEWER OVERFLOWS FROM URBAN AND SEMI-URBAN AREAS IN RICHMOND, VIRGINIA, USA,
Virginia State Water Control Board, Richmond. Piedmont Regional Office.
K. C. Das.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 265-276, 1977. 1 fig, 6 tab.

Descriptors: *Water quality, *Combined sewers, *Overflow, *Basins, *Data analysis, *Richmond(Virginia), Urban runoff, Measurement, Land use, Biochemical oxygen demand, Pollutants, Rainfall, Dry weather, Concentrations, James River(Va).

Until very recently, waste loads from land, storm sewer, and combined sewer overflows have received very little in-depth evaluation as significant pollution sources. Studies indicate that the quantity of pollutants entering the James River at Richmond, Virginia is quite significant. Research has been underway for the past 30 months to determine the impact of 46 overflows at Richmond. The study consists of monitoring six of the representative sources utilizing automatic samplers and special flow measuring devices to define runoff characteristics. These six points were selected on the basis of land-use types including single family, multi-family, commercial, industrial, open space, and combinations thereof. Results indicate that the peak BOD concentrations for the storms considered at the single family sampling stations ranged from 80.0 to 434.0 mg/l. and suspended solids from 109.0 to 1320.0 mg/l.; for multi-family stations, BOD ranged from 44.0 to 850.0 mg/l. and suspended solids from 224.0 to 2240.0 mg/l.; for multiple land-use stations, BOD ranged from 63.0 to 232.0 mg/l. and suspended solids from 208.0 to 1620.0 mg/l. This clearly illustrates that the pollutional characteristics of combined sewer overflows are variable. 'First flush' of suspended solids and BOD is generally exhibited at each station including Shockhoe which has the largest drainage area of 7300.0 acres (29.542 x 10 to the sixth power m sq). The first flush is usually more pronounced in smaller basins. Results of this investigation will aid in reducing pollutant loads from combined sewer overflows to the James River at Richmond. (See also W79-07426) (Bell Graf-Cornell)
W79-07454

THE CHARACTERIZATION OF PARTICULATE SOLIDS AND QUALITY OF WATER DISCHARGED FROM AN URBAN CATCHMENT,
Middlesex Polytechnic, London (England).
J. B. Ellis.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-IASH Publication No. 123, International Association of Hydrological Sciences, p 283-291, 1977. 6 fig, 1 tab, 17 ref.

Descriptors: *Water quality, *Storm water, *Runoff, *Urban catchments, *Particulate solids, Discharge(Water), Pollutants, Chemographs, Flow characteristics, Pollution loads, London(England).

The pollution loads resulting from storm water discharges to receiving streams in urban areas are primarily exerted by high concentrations of particulate materials. Chemographs for a separately sewered development in the northwest suburbs of Greater London show a double peaking of solids and a strong 'first-flush' phenomenon. Occasional lags of the flood wave behind the sediment wave are explained in terms of the flow characteristics and the growth of fungal mats in the sewer system. Pollutants are examined in terms of the characteristics, components and sizes of particulates discharged, and the importance for water quality of the solids fraction below 0.06 mm is demonstrated. (See also W79-07426) (Bell Graf-Cornell)
W79-07456

HEAVY METALS IN WATER, SUSPENDED MATTER AND SEDIMENT,
Bayreuth Univ. (Germany, F.R.) Gehrstuehl fuer Hydrologie.
S. Wolfhard.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 339-343, 1977. 1 fig, 1 tab, 5 ref.

Descriptors: *Heavy metals, *Principal component analysis, Water bodies, Sediments, Suspended matter, Behavior, Water quality, Rivers.

Using principal component analysis, relationships are investigated between heavy metals in solution, suspended matter, and sediment. It can be shown that especially in former mining areas, the heavy metal content in sediment does not reflect the

properties of the water body except for Cu and Ni. Mn and Fe show no relationships at all. The heavy metal content of suspended matter is generally more influenced by sediment than by water. Nevertheless it may show quite a different behavior if special waste waters are discharged, like those containing Cd and Zn. Concerning temporal relationships between dissolved and suspended heavy metal contents, it is strongly suggested that the lack of significant correlations is due to comparison of different dimensions. At least in highly polluted rivers such interrelationships do exist. (See also W79-07426) (Bell Graf-Cornell)
W79-07463

THE MOVEMENT AND CHANGES IN CONCENTRATION OF CONTAMINANTS BELOW A SANITARY LANDFILL, PERTH, WESTERN AUSTRALIA,
Geological Survey of Western Australia, Perth.
T. T. Bestow.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977, IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 370-379, 1977. 4 fig, 1 tab, 3 ref.

Descriptors: *Water quality, *Contaminant concentration, *Hydrochemical studies, *Hydrogeology, *Movement, *Perth(Western Australia), Sanitary landfills, Aquifers, Water balance, Mass balance, Runoff, Equations, Hydrology, Tracer variance, Pollution plume.

A major sanitary landfill situated on the site of a former swamp near Perth has been the subject of a detailed hydrochemical study. Seven sets of boreholes have been used to periodically recover pumped samples from within the landfill and the underlying regional groundwater system over a period of three years. Study of the tracer variance in time and place shows that the components of the pollution plume fall into two groups: those due to natural evaporative concentration of the accession from rainfall and which are essentially stable with respect to time; and those which originate within the introduced land fill and show variance in both time and place. All components exhibit marked differences in ionic mobility in response to the control exercised by peat, which together with dilution in the main aquifer, brings tracer concentrations down to acceptable levels at nearby pumping boreholes. (See also W79-07426) (Bell Graf-Cornell)
W79-07468

POLLUTION OF THE CHALK AQUIFER UNDER THE INDUSTRIAL BUILT-UP AREA OF ROUEN IN THE SEINE VALLEY,
Buerau de Recherches Geologiques et Minieres, Orleans (France). Dept. Carte Geologique et Geologie Generale.
J. C. Roux.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 408-420, 1977. 5 fig, 8 tab.

Descriptors: Alluvial plains, Industries, Chemical pollution, Aquifers, Hydrogeology, Pollutants, Rouen(France), Seine River(France).

This note discusses a case of permanent chemical pollution from industries situated on an alluvial plain. From 1970 to 1976, numerous analyses of samples from drillings in industrial areas in the Valley of the Seine near Rouen (France) resulted in the area being delimited into five zones of pollution around the main chemical industries. The chalk and alluvial aquifer was polluted by excessive amounts of major elements, as well as minor elements and trace metals, hydrocarbons and detergents. The observations over the study period reveal, on the one hand, a great variation in some elements and, on the other hand, an extension and increase of the pollution. (See also W79-07426) (Bell Graf-Cornell)
W79-07471

A STUDY OF THE RE-UTILIZATION OF EFFLUENTS FROM COMMUNAL TREATMENT PLANTS FOR DRINKING WATER PURPOSES,
Landesanstalt fuer Wasser und Abfall Nordrhein-Westfalen, Duesseldorf (Germany, F.R.).
J. Alberti, H. Adelt, and B. Nagel.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 433-440, 1977. 6 fig, 2 tab.

Descriptors: *Water quality, *Reuse, *Effluents, *Waste water treatment, Treatment facilities, Pollutants, Sampling, Drinking, Rhine River(GFR).

Based upon 43 selected parameters with toxic or other properties that impede purification for drinking water purposes, the quality of effluents from waste water treatment plants was compared with that of the Rhine river water. Except the parameters TOC, COD, phosphate, trichloroethylene, 2, 4, 5-trichlorophenolm and zinc, the quality of the effluents from waste water treatment plants was on the average the same or even better than that of Rhine river water. Through certain measures--precipitation of phosphate, ozonization, filtration through activated carbon, passage through the river bank layers--most of these pollutants can be reduced so that the effluents can be made use of as raw water for drinking water purposes. (See also W79-07426) (Bell Graf-Cornell)
W79-07473

5B. Sources Of Pollution

PREDICTING PHOSPHORUS MOVEMENT AND PESTICIDE ACTION IN SALT MARSHES WITH MICROECOSYSTEMS,
Auburn Univ., AL.
J. W. Everest.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 457, Price codes: A05 in paper copy, A01 in microfiche. Doctoral Dissertation, August 24, 1978. 88 p, 7 fig, 10 tab, 110 ref. OWRT A-045-ALA(1).

Descriptors: *Ecosystems, *Salt marshes, *Path of pollutants, *Movement, *Pesticide kinetics, *Phosphorous, Pesticide toxicity, Toxicity, Herbicides, Snails, Gastropods, Pollutants, Soil contamination, Water pollution.

Microecosystems of a salt marsh community were designed and established to determine the mechanism by which phosphorous moves through the different physical and biological components of the community, and to determine the effect of the herbicide, fluometuron, in the salt marsh ecosystem. Tidal flow was simulated by connecting a 'tide machine' to the individual microecosystem seawater reservoirs. In the first study, 32P was inserted deep into the mud, and phosphorus movement was monitored at different times in the different biological and physical components. After four days significant amounts of 32P were found in the S. alterniflora leaves and on the soil surface, and appreciable amounts were found in the animal populations by the eighth day. The second study, using only S. alterniflora and soil with fiddler crabs as the experimental treatments, indicated that the burrowing habit of the fiddler crab appeared to cause a rapid turnover of phosphorus from deep within the soil. In the herbicide study the microecosystem was flooded with 100 ppm fluometuron in sea water. Within 30 days all of the plants were killed; S. alterniflora of all sizes were equally affected. The herbicide treatment completely prevented the emergence of new shoots from the rhizomes. The herbicide did not significantly affect the condition or number of horse mussel and periwinkle snail. It is concluded that microecosystems can be used to predict pollution effects in the natural marsh ecosystem. (Davison-IPA)
W79-07006

AVAILABILITY AND QUALITY OF GROUND WATER IN THE LAKE GEORGE AREA, SOUTHEASTERN PARK COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
K. E. Goddard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 899, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water Resources Investigations 78-50, July 1978. 28 p, 6 fig, 2 tab, 22 ref.

Descriptors: *Groundwater availability, *Water quality, *Aquifer characteristics, *Water pollution sources, *Domestic wastes, Septic tanks, Bacteria, Nitrates, Hydrogeology, Groundwater movement, Path of pollutants, Water yield, Data collections, *Colorado, *Southeastern Park County.

Water for domestic use in the Lake George area, Colo., is produced from four aquifers. Two of the aquifers, fractured-cyrstalline and volcanic rocks, have a water table ranging from 10 to 100 feet below land surface and well yields range from 0.08 to 6 gallons per minute. The consolidated sedimentary-rock and unconsolidated-alluvial aquifers have a water table ranging from near land surface to 60 feet below land surface and well yields range from 2 to 50 gallons per minute. The aquifers generally contain calcium bicarbonate water with concentrations of dissolved solids ranging from 101 to 636 milligrams per liter. In some areas, concentrations of iron as much as 18,000 micrograms per liter and concentrations of fluoride as much as 5.6 milligrams per liter affect suitability for domestic use. Chemical degradation of ground water has occurred in 18 of the 35 wells and in the 1 spring that were sampled. Bacterial contamination was found in water from six wells. (Woodard-USGS)
W79-07014

RECOVERY OF VIRUSES FROM THE MISSOURI RIVER,
Environmental Protection Agency Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 865, Price codes: A03 in paper copy, A01 in microfiche. Report 1971. 22 p, 11 tab, 6 ref.

Descriptors: *Municipal wastes, *Water pollution sources, *Viruses, *Public Health, *Rivers, Diseases, Ultimate disposal, Waste water treatment.

Raw influent and effluent samples were collected from primary treatment plants along the Missouri River, and water samples were collected from selected locations along the Missouri River, to evaluate the viral hazard in the Missouri River. A single viable virus excreted by a human is a dangerous pollutant. Viruses were detected along the Missouri River in effluents, midstream, and at water intakes. A midwinter study at St. Joseph indicated that 360,000 viruses/million gallons of water may exist. All viruses identified were polioviruses and echoviruses. There is a need for developing better methodology for the detection of small numbers of viruses in large volumes of water. (Small-FRC)
W79-07031

POLLUTION FROM MAJOR MUNICIPAL WASTE SOURCES IN DADE COUNTY, FLORIDA,
National Field Investigations Center, Denver, CO.
For primary bibliographic entry see Field 5D.
W79-07054

VIRUSES IN WASTE, RENOVATED AND OTHER WATERS. 1973 LITERATURE ABSTRACTS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-235 048, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-670/9-74-005, 1974. 28 p. Editors: Berg, G., and White, F. D.

Descriptors: *Viruses, *Waste water treatment, *Publications, Water, *Effluent streams.

Seventy-eight abstracts of published literature on viruses in waste, renovated, and other waters, are presented. Journals, books, and conference proceedings published during 1973 are covered. (Small-FRC)
W79-07057

SELECTED CHEMICAL CHARACTERISTICS OF SOILS, FORAGES, AND DRAINAGE WATER FROM THE SEWAGE FARM SERVING MELBOURNE, AUSTRALIA,
Corps of Engineers, Washington, DC.
R. D. Johnson, R. L. Jones, T. D. Hinesly, and D. J. David.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A019 586, Price codes: A04 in paper copy, A01 in microfiche. January 1974. 54 p, 1 fig, 11 tab, 31 ref. Bound with EPA-430/9-75-017, May 1975.

Descriptors: *Irrigation, *Return flow, *Soil chemical properties, *Forages, *Drainage water, Chemical analysis, Overland flow, Oxidation lagoons, Application methods, Australia, Heavy metals, Trace elements, Sewage treatment, Sewage disposal, Filtration, Waste identification, Waste water treatment, Municipal wastes.

A review of the chemical characteristics of sewage, soils, forage, and drainage water from the Werribee Farm land application municipal waste water treatment system in Melbourne, Australia, was performed by the Army Corps of Engineers. The raw sewage reaching the farm is highly concentrated because of the low water usage in the area and contains about 1,788 ppm total solids, 756 ppm volatile solids, 473 ppm suspended solids, 67.9 ppm total nitrogen, 34.5 ppm total phosphorus, 654 ppm Cl, and 578 ppm BOD. Treatment is provided primarily by land filtration in the summer, with additional treatment provided by overland flow and oxidation ponds; the average flow is about 144 mgd. Soils consist of red-brown silty clay loam, calcerous silty clay, and sand. The study showed soils had increased levels of N, C, and P and higher Ca/Mg ratios; soil K was unchanged or reduced. Total soil contents of all trace elements were increased by waste water irrigation; Zn levels were significantly high. Forage contained increased levels of N, P, K, and Na but reduced amounts of Mn. Drainage waters had lower N and P concentrations than secondary effluents from biological treatment plants and about the same concentration levels of several heavy metals. The treatment farm has been in operation since 1897. (Lisk-FRC)
W79-07079

A FILLING-BOX MODEL OF RIVER-DOMINATED LAKES,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 2H.
W79-07105

NUMERICAL SIMULATION OF MIXING IN NATURAL RIVERS,
Stearns and Wheeler, Cazenovia, NY.
T. O. Harden, and H. T. Shen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14501, p 393-408, April 1979. 7 fig, 25 ref, 2 append.

Descriptors: *Dispersion, *Mixing, *Rivers, *Model studies, Mathematical models, Numerical analysis, Simulation analysis, Water pollution, Water quality, Pollutants, Path of pollutants, On-site investigations, Dye releases, Hydraulics, Environmental engineering.

A numerical model was developed for two-dimensional transient mixing in natural river channels. Through the use of an orthogonal curvilinear coordinate system based on the geometry and the flow distribution of the river channel, the physical domain was mapped into a rectangular strip by introducing the cumulative discharge as the new transverse coordinate. The concentration values at each point in the grid system then were determined at time levels by using a combined implicit/explicit finite difference successive scheme. A computer program was developed to solve these equations, and a case study was presented and verified with an existing steady-state analytical solution and field measurement. (Sims-ISWS)
W79-07106

HYDROLOGY AND CHEMICAL QUALITY OF FLOW FROM SMALL PASTURED WATERSHEDS: II. CHEMICAL QUALITY,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
F. W. Chichester, R. W. Van Keuren, and J. L. McGuinness.
Journal of Environmental Quality, Vol. 8, No. 2, p 167-171, April-June 1979. 2 fig, 6 tab, 24 ref.

Descriptors: *Agricultural watersheds, *Water quality, *Pastures, *On-site investigations, *Ohio, Pasture management, Water pollution sources, Grazing, Demonstration watersheds, Small watersheds, Surface runoff, Subsurface flow, Water sampling, Water pollution, Analysis, Pollutants, Nitrogen, Phosphorous, Carbon, On-site data collections, Chlorides, Cattle, Nonpoint source pollution.

A beef cattle-pasturing system involving 4 rotationally grazed summer pastures with winter-feeding on one pasture was studied on sloping upland watersheds in Ohio to determine its effect on chemical quality of water. The concentrations of chemicals in runoff from the pastures, which were summer-grazed only, increased relative to that of incoming precipitation but not enough to significantly impair water quality. No measurable sediment was lost from the pastures used only for summer grazing, allowing no chemical movement via that pathway. Much soil and plant-cover disturbance on the pasture used for winter-feeding, however, resulted in increased runoff, some surface erosion, and more chemical movement as compared with the pastures grazed only in summer. Considerably more chemicals moved in subsurface than in surface flow from the summer pastures, while amounts of chemicals transported from the winter-feeding pasture were equally great in surface runoff and subsurface flow. Watershed surface management was a key factor in determining the flow route of water in excess of that used for evapotranspiration and, hence, the pathways and amounts of chemical transport from the pastures. (See also W79-07132) (Humphreys-ISWS)
W79-07133

INTENSIVE SITE PREPARATION AND SEDIMENT LOSSES ON STEEP WATERSHEDS IN THE GULF COASTAL PLAIN,
Arkansas Univ. at Monticello. Dept. of Forestry.
For primary bibliographic entry see Field 4D.
W79-07140

OBSERVATIONS ON THE GEOCHEMISTRY OF SOLUBLE COPPER, IRON, NICKEL, AND ZINC IN THE SAN FRANCISCO BAY ESTUARY,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
For primary bibliographic entry see Field 5A.
W79-07144

ISOTOPIC ABUNDANCES OF LEAD IN ESTUARINE SEDIMENTS, SWANSEA BAY, BRISTOL CHANNEL,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W79-07148

LEAD-210 CHRONOLOGY IN RELATION TO LEVELS OF ELEMENTS IN DATED SEDIMENT CORE PROFILES,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W79-07149

ORGANIC CARBON ISOTOPE RATIOS IN RECENT SEDIMENTS IN THE ST. LAWRENCE ESTUARY AND THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 2L.
W79-07150

HERBICIDE RUNOFF FROM UPLAND PIEDMONT WATERSHEDS--DATA AND IMPLICATIONS FOR MODELING PESTICIDE TRANSPORT,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 5A.
W79-07154

RUNOFF WATER QUALITY AS AFFECTED BY SURFACE-APPLIED DAIRY CATTLE MANURE,
Science and Education Administration, Auburn, AL.
F. L. Long.
Journal of Environmental Quality, Vol. 8, No. 2, p 215-218, April-June 1979. 1 fig, 4 tab, 16 ref.

Descriptors: *Farm wastes, *Waste disposal, *Water quality, Water pollution, Water pollution sources, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Nitrates, Grasses, Nutrients, Rainfall, Runoff, Cattle, Drainage, Hydrogen ion concentration, Conductivity, Pollutants, Path of pollutants, Farms, Dairy cattle manure.

The effect of dairy cattle manure on runoff water quality was determined. The manure was surface-applied to Coastal bermudagrass on a Norfolk sandy loam with less than 2% slope at the rate of 45 metric tons/ha per year for 4 years in split applications. Manure applications slightly increased biochemical oxygen demand (BOD) values of runoff water; the maximum value was less than 20 mg/liter and annual mean values were all less than 10 mg/liter with no BOD buildup in the runoff water over the 4-year period. Nitrate levels in runoff water were increased by the manure, but all annual mean values were below critical levels at less than 8 mg NO3-N/liter. During the first 2 years, about 30 kg/ha total N was lost in runoff, but less than 6 kg N/ha was lost during the third and fourth years. (Sims-ISWS)
W79-07155

TRACE ELEMENTS IN FLY ASH AND THEIR RELEASE IN WATER AND TREATED SOILS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-07159

EVALUATION OF CHANGES IN THE NILE WATER COMPOSITION RESULTING FROM THE ASSWAN HIGH DAM,
Alexandria Univ. (Egypt). Dept. of Soil and Water Science.
For primary bibliographic entry see Field 3C.
W79-07160

LAND USE INFLUENCES ON HEAVY METALS IN AN URBAN RESERVOIR SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
D. R. Helsel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 724, Price codes: A11 in paper copy, A01 in microfiche. Ph.D. Dissertation, July, 1978. 61 fig, 46 tab, 160 ref, 2 append. OWRT B-103-VA (2).

Descriptors: *Heavy metals, *Land use, *Stormwater runoff, Urban runoff, Nonpoint pollution, Reservoirs, Urbanization.

Small basins, each of one land-use type, provided stormwater runoff for analysis of copper, chromi-

um, cadium, lead, zinc, iron, and manganese. Atmospheric contributions (precipitation and dustfall), as well as land surface inputs to stormwater, were evaluated. Urban areas were greater yearly producers per acre of lead, zinc, copper, cadium and chromium than are agricultural areas, while producing equivalent amounts of iron, manganese, and suspended solids. Nonpoint inputs to the reservoir were many times greater, on a yearly basis, than metals from the only point source--treated sewage effluent. The majority of metals were found to attach to bottom sediments, remaining behind the dam. Increased upstream urbanization will therefore provide more metals to the reservoir system, but not to the public drinking water intake. Unless an unforeseen mobilization of sediment metals occurs, no public health concern is warranted for metals in the reservor.
W79-07167

POLLUTANT MOVEMENT TO SHALLOW GROUND WATER TABLES FROM ANAEROBIC SWINE WASTE LAGOONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
T. G. Ciravolo, D. C. Martens, D. L. Hallock, E. R. Collins, Jr., and E. T. Kornegay.
Journal of Environmental Quality, Vol. 8, No. 1, p 126-130, January-March 1979. 5 tab, 12 ref. OWRT B-068-VA (2).

Descriptors: *Farm lagoons, *Hogs, *Farm wastes, Virginia, Seepage, Lagoons, Groundwater, Shallow wells, Water pollution sources, Chlorides, Nutrients, Nitrogen compounds, Coliforms, Path of pollutants.

The effect of three anaerovic swine waste lagoons on groundwater quality was investigated in the Atlantic Coastal Plain region. The lagoons studied were located on high-water-table soils with different textures. Groundwater was sampled from wells, with unperforated casings, located at depths to 6 m and distances to 30 m from the lagoons. These samples were taken monthly from September 1974 through January 1975, and bimonthly thereafter through November 1975. Groundwater also was sampled in November 1975 from shallow wells, with perforated casings, located at distances to 36.6 m from 2 of the 3 lagoons. Constituents determined to investigate groundwater contamination were density of fecal coliforms and concentrations of Cl, Cu, Mn, NH4-N, NO3-N, PO4-P, and Zn. Chloride, NH4-N, and NO3-N concentrations in groundwater samples indicated that seepage entered groundwater from each of the 3 lagoons. Rupture of lagoon seals leading to seepage was attributed to drying of exposed subsoil or embankment soil during recession of lagoon liquid levels and to gas release from microbial activity in soil beneath the seal. (Sims-ISWS)
W79-07229

TRANSFRONTIER POLLUTION: PLAINTIFF CAN CHOOSE HIS COURT,
A. Rest.
Environmental Policy and Law, Vol. 3, No. 1, p 41-46, March 1977.

Descriptors: *Jurisdiction, *International law, *Environmental control, Pollutants, Europe, Adjudication procedure, Judicial decisions, Damages, Legal aspects, Interstate compacts.

One of the major problems in the field of environmental protection is the prevention of transfrontier environmental injuries. In a highly industrialized society, the infringement of individual rights caused by environmental damage is not likely to be totally eliminated. This has created a need for a satisfactory solution concerning a way to sue for compensation. It is the jurisdictional aspect of this problem which creates the most significant problems. 'Forum delicti' competence, which is provided for in European states as a distinct place of jurisdiction, is not precise enough and can lead to uncertainty. A definition of the 'forum delicti' was finally announced by the Court of Justice of the European communities on Nov. 30, 1976. The court held that the 'forum delicti commisi' in transfrontier pollution cases meant the place where the tortfeasor began to act as well as the place where the injurious result occurred. The decision explicitly states that the plaintiff has the right to sue in either of these places. (Goldberg-Florida)
W79-07234

WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07239

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07241

GROUNDWATER POLLUTION IN SOUTH DAKOTA: A SURVEY OF FEDERAL AND STATE LAW,
For primary bibliographic entry see Field 6E.
W79-07247

AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL UNDER SECTIONS 208 AND 303 OF THE CLEAN WATER ACT: HAS FORTY YEARS OF EXPERIENCE TAUGHT US ANYTHING,
For primary bibliographic entry see Field 6E.
W79-07248

NON-POINT POLLUTION AND ALASKA,
For primary bibliographic entry see Field 6E.
W79-07269

DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS: II. EXPERIMENTAL,
Colorado State Univ., Fort Collins; and Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 2G.
W79-07284

DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS: I. THEORY,
Colorado State Univ., Fort Collins; and Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 2G.
W79-07285

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME I,
For primary bibliographic entry see Field 5C.
W79-07287

INTRODUCTION.
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07288

LOW-MOLECULAR-WEIGHT HYDROCARBON AND HYDROGRAPHIC PROJECT,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W79-07290

HIGH-MOLECULAR-WEIGHT HYDROCARBONS IN ZOOPLANKTON, SEDIMENT AND WATER: TOTAL ORGANIC CARBON AND DELTA C13 IN SEDIMENT: SUMMARY OF HIGH-MOLECULAR-WEIGHT HYDROCARBON ANALYSES CARRIED OUT IN SUPPORT OF THE MICROBIOLOGY PROJECT AND THE TOPO-HIGH PROGRAM,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
P. L. Parker, R. S. Scalan, J. K. Winters, R. Anderson, and T. Burton.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 4-1 - 4-47, January 15, 1979. 3 fig, 22 tab, 9 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Water pollution effects, *Zooplankton, *Sediments, Environmental effects, Resources development, Texas, *Outer Continental Shelf, *Hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons, Petroleum development, South Texas Outer Continental Shelf(STOCS).

An extensive survey of the level of natural and petroleum type hydrocarbons in seawater, zooplankton and sediment from the South Texas Outer Continental Shelf (STOCS) was made. The presence or absence of indicator parameters, including n-paraffins, odd-even ratios, unresolved GLC humps, and GC/MS confirmation of aromatic hydrocarbons, were taken as a measure of petroleum contamination. Some Zooplankton samples showed contamination with petroleum-like hydrocarbons. Dissolved and particulate hydrocarbons in seawater were determined in 56 samples. Hydrocarbon analyses of 15 sediment samples from the open shelf showed that the sedimentary environment was still a pristine one. No gross contamination of sediments with petroleum-like hydrocarbons has been observed. Total organic carbon content increased with increasing distance from shore, probably reflecting the increasing clay content of the sediments. Stable carbon isotope distributions were fairly uniform throughout the STOCS area. A possible trend of more positive Delta C13 values shoreward may have been due to inclusion of estuarine derived organic matter (seagrasses) in these sediments. (See also W79-07287) (Sinha-OEIS)
W79-07291

HEAVY MOLECULAR WEIGHT HYDROCARBONS IN MACROEPIFAUNA AND MACRONEKTON SAMPLES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
C. S. Giam, H. S. Chan, G. Neff, Y. Hrung, and D. Garey.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 5-1 - 5-23, January 15, 1979. 2 fig, 5 tab, 8 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Water pollution sources, *Water pollution effects, *Biota, Environmental effects, Texas, Oil pollution, Fishes, Shellfish, *Outer Continental Shelf, *Hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons, Petroleum development, Oil transport, South Texas Outer Continental Shelf(STOCS).

A total of 207 samples of benthic macroepifauna and macronekton from the South Texas Outer Continental Shelf (STOCS) was analyzed for heavy-molecular-weight hydrocarbons. These analyses included samples of muscle, liver, and gonads. Five (5) large samples, 36 intraspecific variability samples and 3 ship's contaminant samples were also analyzed. The samples generally had very low levels of total hydrocarbons, averaging 2 ppm or less, with C15 and C17 alkanes and pristane predominating. The aliphatic hydrocarbon distribution and the very low levels of phytane and aromatic hydrocarbons (generally 0.01 ppm or less) detected were suggestive of biogenic origins for the hydrocarbons in the samples analyzed. The absence of correlations in the pristane/phytane, pristane/C17, phytant/C18 and CPI14-20 ratios also implied the absence of significant levels of petroleum in the organisms analyzed. The hydrocarbons detected in biota were of mainly biogenic origin. Occasionally, some evidence of hydrocarbons of petroleum origin were found, but the levels were very low suggesting very little contamination of the study area. The hydrocarbon profiles for a large number of species were obtained. These profiles provided a wide data base for determining the

effects of petroleum exploration and production on the hydrocarbon content of biota from the STOCS. (See also W79-07287) (Sinha-OEIS)
W79-07292

TRACE METALS IN EPIFAUNA, ZOOPLANKTON AND MACRONEKTON,
Texas A and M Univ., College Station. Dept. of Oceanography.
B. J. Presley, P. N. Boothe, D. Baranowski, and S. Schofield.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol. I,' p 6-1 - 6-47, January 15, 1979. 8 tab, 9 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Water pollution sources, *Heavy metals, *Metals, *Zooplankton, Water pollution effects, Environmental effects, Texas, Fishes, Shellfish, *Outer Continental Shelf, Trace metals, South Texas Outer Continental Shelf(STOCS).

Concentrations of 10 metals (Al, Ca, Cd, Cr, Cu, Fe, Ni, Pb, V, Zn) were determined in 340 samples including: zooplankton; muscle tissue from fish and shrimp; fish gill and liver tissue; and shrimp hepatopancreas. Concentrations were determined by flame atomic absorption spectroscopy (AAS) (Cu, Fe, Zn), flameless AAS (Cd, Cr, Ni, Pb) and neutron activation analysis (Al, Ca, V). No indication of substantial heavy metal pollution was observed. The amount of variability in trace metal concentrations among the major sample groups in 1977 was similar to that observed in 1976. For zooplankton sampled, Pb concentrations decreased offshore, and Cd levels showed the reverse trend. The levels of all metals except Cd were highest in the fall season. Fish and shrimp muscle had generally low, uniform trace metal levels with few apparent geographical, seasonal or interspecific differences. Fish species in order of decreasing total content of trace metals were Rhomboplites aurorubens, Stenotomus caprinus, Pristipomoides aquilonaris, Lutjanus campechanus, and Serranus atrobranchus. Both species of shrimp analyzed had similar levels of trace metals in their hepatopancreatic tissue. This tissue contained the highest Ni levels of any sample type analyzed. Cadmium levels were similar to those in fish livers. Cadmium and Ni levels were maximal in the winter season. No consistent geographic trends were apparent. (See also W79-07287) (Sinha-OEIS)
W79-07293

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME II,
For primary bibliographic entry see Field 5C.
W79-07298

ACID RAIN: NEUTRALIZATION WITHIN THE HUBBARD BROOK ECOSYSTEM AND REGIONAL IMPLICATIONS,
Dartmouth Coll., Hanover, NH. Dept. of Earth Sciences.
N. M. Johnson.
Science, Vol. 204, No. 4392, p 497-499, May 4, 1979. 2 fig, 1 tab, 16 ref.

Descriptors: *New England, *New Hampshire, *Precipitation(Atmospheric), *On-site investigations, *Watersheds(Basins), *Fallout, Pollutants, Acids, Acidity, On-site data collections, Water quality, Hydrogen ion concentration, Acidic water, Aluminum, Silica, Water analysis, Streams, Neutralization, Acid rain.

The purpose was to describe and explain the process by which acid rain is transformed into chemically normal stream water. The chemical character of a small stream, Falls Brook, has been monitored over a 3-year period. Nine sites along this drainage network have been sampled on a monthly basis over three annual cycles. Water samples were collected and chemically analyzed. The chemical data from Falls Brook show that the neutralization of acid rain is rapidly and largely (about 75%) accomplished in the upper soil or regolith by the dissolution of preexisting aluminum hydroxide compounds and by the leaching of bases from various biologic materials. On a regional basis, acidified and aluminum-rich lakes and streams in New England are confined mainly to low-order watersheds. (Humphreys-ISWS)
W79-07311

THE SIGNIFICANCE OF SEWAGE EFFLUENT FOR THE HYDRAULIC AND NUTRIENT LOADS ON LAKES,
National Swedish Environmental Protection Board, Uppsala (Sweden). Inst. of Physiological Botany.
S-O. Ryding.
Progress in Water Technology, Vol. 10, No. 6, p 907-916, 1978. 4 fig, 2 tab, 23 ref.

Descriptors: *Storm runoff, *Sewage effluents, *Nutrients, *Lakes, Waste water treatment, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Sampling, Ammonia, Nitrogen, Nitrates, Nitrites, Phosphorus, Phosphates, Organic matter, Water quality, *Sweden.

Studies of hydraulic and nutrient loads as natural and municipal (sewage effluent) input to wastewater receiving lakes were carried out in 8 drainage basins. Results from two drainage basins, quite different with regard to human activities, were presented in more detail. The results could be summarized in the following way: (1) sewage effluent quality showed great variations; (2) ammonia and nitrite+nitrate concentrations showed an opposite variation pattern in sewage effluent; (3) sewage effluent was the dominant source of ammonia; (4) sewage effluent played a minor role for the hydraulic load and as a source of organic matter; (5) the relative phosphate load from sewage effluent (compared with the total phosphate load on the lakes) exceeded the relative load of total phosphorus from the plant--this was valid in areas not too influenced by man; and (6) the role of sewage effluent as a nutrient source was enhanced during the vegetation period. (Sims-ISWS)
W79-07319

A MASS BALANCE METHOD FOR ESTIMATING COMBINED SEWER RUNOFF AND OVERFLOW QUALITY FROM SEWAGE TREATMENT PLANT DATA,
Manhattan Coll. Bronx, NY. Environmental Engineering and Science Program.
J. A. Mueller, and A. R. Anderson.
Progress in Water Technology, Vol. 10, No. 6, p 727-739, 1978. 7 fig, 4 tab, 7 ref.

Descriptors: *Urban runoff, *Combined sewers, *Sewage treatment, *Model studies, *New York, Mathematical models, Pollutants, Path of pollutants, Storm runoff, Sewage, Biochemical oxygen demand, Suspended solids, Runoff, Flow, Water pollution, Water pollution sources, Rainfall-runoff relationships, Water quality, Precipitation(Atmospheric), Mass balance models.

An indirect method of estimating urban stormwater runoff and overflow loads and concentrations from combined sewer systems was presented. A mathematical framework consisting of mass and flow balances for the sewer system and its attendant treatment plant was used with treatment plant sampling data and rainfall data as input. The mass balance was applied to the drainage area of the 26th Ward Water Pollution Control Plant in Brooklyn, New York, which drains to Jamaica Bay. Data from this plant on suspended solids, volatile suspended solids and total and soluble BOD were available for the period 1945-1975, and 7 of these years (1951, 54, 57, 60, 66, 69) were analyzed in depth. Mean annual values of load and concentration for these constitutents were compared with others' directly sampled runoff and overflow data. Sensitivity of model results to variations in several input parameters was checked. The approach was suggested as an economical and accurate alternative to sampling programs or presently available deterministic runoff quality mathematic models for areawide assessment over a long time scale. (Sims-ISWS)
W79-07320

A STUDY OF STORMWATER RUNOFF QUALITY,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W79-07321

SOURCES AND CONCENTRATIONS OF NITRATE-NITROGEN IN GROUND WATER OF THE CENTRAL PLATTE REGION, NEBRASKA,
Nebraska Univ., Lincoln. Div. of Conservation and Survey.
J. R. Gormly, and R. F. Spalding.
Ground Water, Vol. 17, No. 3, p 291-301, May-June 1979. 8 fig, 3 tab, 45 ref.

Descriptors: *Nitrogen, *Nebraska, *Nitrates, *Groundwater, *Water pollution sources, Fertilizers, Farm wastes, Pollutants, Path of pollutants, Denitrification, Soils, Organic matter, Feed lots, Water wells, Isotope studies, Water pollution, Agriculture, *Buffalo County(NB), *Hall County(NB), *Merrick County(NB).

During 1976-77, nitrate-nitrogen (NO3-N) concentrations exceeded 10 mg/l in 183 of the 256 groundwater samples collected from parts of Buffalo, Hall, and Merrick Counties in Nebraska. Comparison of the isotopic values with those of potential nitrate sources suggested that the primary source of contamination in most wells was fertilizer and that a small percentage of the wells contained significant concentrations of NO3-N derived from animal wastes. A combination of two or more sources of contamination was assumed for those samples for which the source could not be identified. Significant negative correlations between delta 15N and NO3-N (-0.35 in Buffalo and Hall Counties) and between delta 15N and depth to water (-0.55 in Merrick County) indicate that denitrification is the major factor in isotopic fractionation of nitrogen from the nitrate source. (Sims-ISWS)
W79-07322

LEVELS OF AMMONIUM, SULFATE, CHLORIDE, CALCIUM, AND SODIUM IN SNOW AND ICE FROM SOUTHERN GREENLAND,
State Univ. of New York at Buffalo, Amherst. Ice Core Lab.
E. Busenberg, and C. C. Langway, Jr.
Journal of Geophysical Research, Vol. 84, No. C4, p 1705-1709, April 20, 1979. 5 fig, 3 tab, 28 ref.

Descriptors: *Snow, *Ice, *Pollutants, *Data collections, Chemical analysis, Sulfates, Chlorides, Calcium, Sodium, Cations, Analysis, Variability, *Greenland, Ammonium.

Chemical analysis of surface snows and dated ice core samples from Dye 3, Greenland, suggests that the ammonium cation is a major constituent in all samples and that the annual ammonium levels present in the south Greenland samples have varied from 3.3 to 26.3 microgram/kg between the seventeenth century and the present time. The annual range of 1974-1975 surface samples was between 3.8 and 8.8 microgram/kg, while the mean was 5.7 + or - 1.8 microgram/kg. The recent large-scale uses of fixed nitrogen fertilizers and industrial pollution have apparently not affected the levels of ammonia reaching southern Greenland. The sodium and chloride present are predominantly derived from ocean spray, while more than 90% of the calcium is of continental origin. The levels of these 3 elements apparently have not been affected by human activity since the industrial revolution. Sulfate levels have increased dramatically since the industrial revolution, suggesting that sulfate of antropogenic origin is the most important source of sulfate in modern snows from southern Greenland. The amount of the sulfuric acid neutralized by the ammonium cations was approximately 100% in the 17th and 18th centuries, dropping to approximately

20% in the 1974-1975 samples. These figures imply that there has been an increase in the acidity of precipitation in southern Greenland since the end of the 18th century. (Humphreys-ISWS)
W79-07329

POLLUTION HISTORY OF THE SAVANNAH RIVER ESTUARY,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2L.
W79-07330

SOURCES AND MOVEMENT OF ORGANIC CHEMICALS IN THE DELAWARE RIVER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
L. S. Sheldon, and R. A. Hites.
Environmental Science and Technology, Vol. 13, No. 5, p 574-579, May 1979. 7 fig, 3 tab, 20 ref.

Descriptors: *Water pollution sources, *Organic compounds, *Pennsylvania, *Tidal streams, *Delaware River, On-site investigations, Pollutants, Sampling, Monitoring, Chemical analysis, Water quality, Analytical techniques, Testing, Methodology, Chromatography, Spectrophotometry, Data collections, Phenols, *Philadelphia(PA), Chlorinated compounds, Plasticizers, Ethylene glycol derivatives.

The transport of industrial organic chemicals from their source, into the Delaware River, through various treatment facilities, and into Philadelphia's finished drinking water was studied using water samples collected in August 1977. Solvent extraction, liquid chromatographic cleanup, and chromatographic mass spectrometry were used for compound separation and identification. Results confirmed discharge sources for many previously identified compounds. Furthermore, it was shown that many of these compounds circulated into Philadelphia's drinking water, and that the various water and waste treatment facilities had a minimal effect on the organic levels. For all chemicals, dilution processes were responsible for the largest reduction in organic concentrations. Results were substantiated by a 10-week sampling program designed to monitor 7 selected waste chemicals. (Humphreys-ISWS)
W79-07331

ACCUMULATION OF POLYCHLORINATED BIPHENYLS (PCBS) IN SURFICIAL LAKE SUPERIOR SEDIMENTS. ATMOSPHERIC DEPOSITION,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
S. J. Eisenreich, G. J. Hollod, and T. C. Johnson.
Environmental Science and Technology, Vol. 13, No. 5, p 569-573, May 1979. 1 fig, 3 tab, 40 ref.
NSF ENG7609432, OCE7602255.

Descriptors: *Lake Superior, *Pollutants, *Polychlorinated biphenyls, *Fallout, *Great Lakes, *Canada, Sediments, Cores, Sampling, Sedimentation rates, Analysis, Analytical techniques, Testing, Methodology, Lakes, Water pollution sources, On-site investigations, Data collections, *Thunder Bay(Ontario), *Keweenaw Peninsula(Ontario), Surficial sediments.

Sediment cores were obtained from Lake Superior by means of an oceanographic box corer and analyzed for polychlorinated biphenyls (PCBs). Concentration of PCBs in the top 0.5 cm averaged 0.17 + or - 0.13 microgram/g of sediment on a lakewide basis. The maximum PCB concentrations were found in surficial sediments between the Keweenaw Peninsula and Thunder Bay in the prevailing downwind direction of Thunder Bay, Ontario. Depth-fractionated sediments yielded no detectable PCBs at depths greater than 3 cm below the sediment-water interface, and they often were not detected below a burial depth of 1 cm. The depth of sediment turbation by biotic or physical processes appears to be less than 1 cm. PCB input to Lake Superior from the atmosphere (dry, wet, gaseous) is estimated as 3-8 million g/yr, and can account for sedimentary PCB concentrations. The PCB sedimentation rate in Lake Superior is estimated as approximately 0.3-0.4 microgram/sq m/yr. The results of this study suggest that atmospheric transport and deposition may dominate PCB input to the Lake Superior ecosystem. (Humphreys-ISWS)
W79-07332

ENVIRONMENTAL POLY(ORGANOSILOXANES) (SILICONES),
Naval Research Lab., Washington, DC. Ocean Sciences Div.
For primary bibliographic entry see Field 2L.
W79-07333

MIREX AND THE CIRCULATION OF LAKE ONTARIO,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
R. L. Picket, and D. A. Dossett.
Journal of Physical Oceanography, Vol. 9, No. 2, p 441-445, March 1979. 5 fig, 8 ref.

Descriptors: *Path of pollutants, *Great Lakes, *Lake Ontario, *Water circulation, *Model studies, Mathematical models, Circulation, Currents(Water), Sediments, Lake sediments, Bottom sediments, Deposition(Sediments), Pollutants, Water pollution, Water quality, Lakes, Limnology, Mirex.

The observed pattern of mirex in Lake Ontario's sediments is consistent with what is known about the Lake's long-term circulation. A reasonable simulation of the mirex pattern was obtained using a steady-state circulation model coupled to a simple water quality model. The equivalent 10-year mirex accumulation on the lake bottom from these numerical models is similar to the observed mirex pattern. (Sims-ISWS)
W79-07334

BIOLOGICAL RELEASE AND RECYCLING OF TOXIC METALS FROM LAKE AND RIVER SEDIMENTS,
Australian National Univ., Canberra. Dept. of Zoology.
W. L. Nicholas, and M. Thomas.
Australian Water Resources Council Technical Paper No. 33, 1978. 111 p, 20 fig, 43 tab, 40 ref, 4 append. 74/69.

Descriptors: *Heavy metals, *Water pollution sources, *Mine wastes, *Zinc, *Water pollution effects, Environmental effects, Animal physiology, Plant tissues, Sediments, Riverbeds, Copper, Lead, Pyrite, Chromium, Cobalt, Manganese, Nickel, Iron, Molonglo River(New South Wales Australia).

Heavy metal wastes from the abandoned Lake George Mines have polluted the Molonglo River below Captain's Flat in New South Wales. The flora and fauna of the river are severely depleted for many kilometers, and in 1975 the riverbed was lifeless immediately below Captain's Flat. The rich flora and fauna existing 30 km downstream from Captain's Flat are influenced by the pollution. Although recent civil engineering work is expected to prevent further pollution of the river from the abandoned mines, it will not reduce the pollutants already present in the river. Chemical analyses of plants and animals living in the river below the most polluted section of the river and bottom sediments from the riverbed show that zinc, the major pollutant, is present in great quantities in the river system and in plant and animal tissues. The very high concentrations of zinc were firmly bound by organic detritus, which retains the capacity to bind more zinc of the pH of the river water as long as the zinc remains in the water. Bull rushes and willows absorb zinc from the river sediments, and the dead leaves continue to adsorb zinc until they disintegrate. Microorganisms also absorb zinc from the river and retain it in zinc-free water. Invertebrates feeding on the microorganisms and detritus ingest zinc, retain some in their tissues, and excrete much of it, thus releasing it into the river. Plants growing in the river take up zinc from the sediments and recycle it in their decomposing remains, either in situ, on land, or downstream. (Davison-IPA)
W79-07346

BENEFITS AND COST OF SEASONAL EFFLUENT PERMITS IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
D. Hargett, and J. A. Seagraves.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 147, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute University of North Carolina Report No. 135, January 1979. 41 p, 5 tab, 3 append. OWRT A-101-NC(1). 14-34-0001-8035.

Descriptors: *Costs, *Benefits, *Effluent permits, Dissolved oxygen, North Carolina, Social benefits, Water quality standards.

In the winter the capacity of North Carolina streams to assimilate oxygen-demanding wastes increases due to higher dissolved oxygen saturation levels and increased streamflows. Waste treatment plants are designed to meet water quality standards which are based on summer conditions when waste assimilative capacities are lowest due to high temperatures and reduced flows. The seasonal effluent permits proposed by the North Carolina Department of Natural Resources and Community Development would allow up to a doubling of the discharge of BOD wastes for the most severely restricted discharges during the months November through March. These winter-summer permits could result in large benefits to the State of North Carolina (a rough estimate of the savings in waste treatment costs is $2.9 million per year). No quantifiable social costs (negative effects on the environment, health, or production), and practically no additional administrative costs were found. It is suggested that it might be appropriate to schedule hearings on the proposed changes in regulations. (Kiger-North Carolina)
W79-07419

WATER QUALITY DEGRADATION DUE TO NON-POINT POLLUTION INPUT FROM URBAN SOURCES,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. B. Carberry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 182, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Delaware University, Research Project Technical Completion Report, January 1979. 97 p, 51 fig, 19 tab, 75 ref, 1 append. OWRT B-012-DEL(1).

Descriptors: *Water quality, *Water pollution, *Water pollution sources, *Path of pollutants, *Lead, *Cadmium, *Urban drainage, Urban runoff, Urban hydrology, Storm runoff, Rainfall, Impact(Rainfall), Sampling, Christiana River(Newark, Delaware).

Dry and wet weather samples were collected from five stations on the Christiana River in Newark, Delaware, and analyzed for cadmium and lead to determine the impact of urban runoff on stream water quality. Each station depicted a different degree of urbanization, and the stations characterized by urban upstream reaches showed the greatest variation between wet and dry weather stream water quality. Regression analysis was used to relate stream water quality to the following hydrological variables in each reach: flowrate, total antecedent rainfall, time from storm start, and antecedent dry period preceding the last storm. Lead concentrates in stream samples were directly related to flowrate for all stations sampled, and mass flux of lead increased with flow rate. This confirmed that inputs of lead continued to the River during storm events. The mass influx of cadmium was reduced at large flowrates indicating less impact of non-point sources of cadmium than for lead. Cadmium and lead concentrations in stream

samples were related to the amount of antecedent rainfall subsequent to sample collection. The agreement found for 24 or 48 hour antecedent periods suggested that non-point inputs of these metals affected stream water quality for periods of 48 hours or less. Longer term impacts of urbanization on River quality were confirmed when concentrations of lead remained elevated for up to 48 hours several miles below the urban area. The highest average concentrations of lead for wet and dry periods found at urban upstream reaches confirmed the relationship between urbanization and stream quality degradation within this study area. (Davison-IPA)
W79-07421

SIMULATION VERSUS A PROBABALISTIC APPROACH FOR EVALUATING STORM-WATER TREATMENT ALTERNATIVES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
W. A. Melville, and J. M. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 194, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No. 105, June 1979. 133 p, 44 fig, 40 tab, 15 ref, 3 append. OWRT C-6106(5213)(9).

Descriptors: Urban runoff, Unit hydrograph, Peak discharge, Rainfall, Precipitation excess, Detention storage, *Stormwater management, *Suburban watersheds, Pollutograph, ILLUDAS, STORM, Kolmogorov-Smirnov tests.

The intent of the report is to demonstrate the applicability of the stormwater management model STORM as a planning tool for water quality control of suburban watersheds. In the development of the analysis several minor objectives were also met. The first was the development of a methodology to calibrate STORM using magnitude of pollutant washoff and pollutograph profile comparison via the Kolmogorov-Smirnov statistic. This methodology proved effective in demonstrating the superior predictability of suspended solids over BOD5. A significant finding was the development of a methodology to estimate the percent of pollutant overflow for a given storage level without the need of computer simulation. A storage utilization curve derived from the rainfall mass curve was found to be indicative of the storage utilization for pollutant removal. This method compared favorably with the STORM predictions. A comparison of a global economic analysis revealed that four to five overflows per year is optimal economically. Also these values coincide with the optimal pollutant removal, where the storage of an equivalent of a one inch event with a treatment rate of 0.01 - 0.02 runoff inches per hour would be more than sufficient for the watersheds studied.
W79-07423

URBAN STORM WATER POLLUTANT SOURCES,
Chaumers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
P. A. Malmquist, and G. Svensson.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 31-38, 1977. 1 fig, 12 tab, 6 ref.

Descriptors: *Urban hydrology, *Storm water, *Effects, *Pollutant sources, *Water quality, Corrosion, Population, Zinc, Copper, Lead, Suspended solids, Rainfall, Runoff, Air, Monthly, Evaluation, Regression analysis, Mathematical models, Systems analysis, Traffic, Atmospheric fallout, Building materials, Street sweeping, Mass flows, Refuse incineration, Catchments, Goteborg(Sweden).

Four urban and suburban areas in Goteborg have been investigated with respect to storm water quality and its sources of pollution. The sources studied were primarily atmospheric fallout and the corrosion of building materials, but traffic and population were also considered. The mass flows of zinc and copper in the storm water proved to be caused by fallout and corrosion. Lead could, as expected, be explained by the traffic. The frequency and effectiveness of street sweeping are important to the lead content in the storm water. The mass flows of suspended solids, COD, and phosphorus may be correlated to traffic and population, but phosphorus also was proved to originate from fallout. Point sources like a refuse incineration plant in one of the areas markedly increased the concentrations of pollutants in the storm water. The results of this investigation will be used to develop an entirely new type of storm water quality model, based on the pollutant sources. (See also W79-07426) (Bell Graf-Cornell)
W79-07430

EFFECTS OF URBANIZATION ON PHOSPHORUS FLOWS IN A RESIDENTIAL SYSTEM,
Nova Scotia Technical Coll., Halifax.
D. H. Waller.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 52-58, 1977. 3 fig, 1 tab, 20 ref.

Descriptors: *Effects, *Urbanization, *Phosphorus, *Flow, *Water quality, *Stormwater runoff, *Water balance, *Residential system, Annual, Nutrients, Ecosystems, Precipitation, Evapotranspiration, Sewage, Estimating, Vegetation, Systems analysis, Mathematical models, Atmosphere.

A model represents, on an annual basis, water and nutrient flows into and through a residential system. Changing model parameters to represent alternative development patterns helps to illustrate the dramatic effects of urbanization on nutrient flows. Analysis of sources and magnitudes of phosphorus discharges from a 1-ha residential area suggests that vegetation is the principal source of phosphorus, and that explicit consideration of individual sources may be a useful approach to prediction of phosphorus loads from urban areas. (See also W79-07426) (Bell Graf-Cornell)
W79-07433

WATER BUDGET FOR A HOUSING AREA IN GOTEBORG,
Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Water Supply and Sewerage.
P-A. Malmquist, and G. Svensson.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 101-108, 1977. 4 fig, 7 tab, 3 ref.

Descriptors: *Water budget, *Sewer systems, *Flow, *Water quality, *Water quantity, *Goteborg area(Sweden), Measurement, Rainfall-runoff relationships, Storm water, Pollutants, Drainage water, Storage capacity, Surface waters, Consumption water, Housing area.

Torslanda, a suburban area, located in the Goteborg area on the west coast of Sweden, was investigated with respect to the functioning of sewer systems. Both quantity and quality were considered. Based on measurements of rainfall, drinking water consumption, sewage and storm water flow, a water budget was calculated. A distinction was made between drainage water, sewage and storm water in the separate sewer system. In this area, it was found that the drainage water flow range is 0.4-1.5 times the average sewage flow. During rainfall the sewer takes up to 30 percent of the total runoff volume, and the maximum leakage flow is 5 times the average sewage flow. Thus the separate sewer system does not perform very well with respect to quantity. The mass flows of SS, BOD, P, and Pb were calculated, and it was found that the mass flows of pollutants were less than for a combined sewer system. The mass flows of pollutants were, however, nearly of the same magnitude as those of a combined system with storage capacity. (See also W79-07426) (Bell Graf-Cornell)
W79-07440

HYDROLOGICAL SETTING AND WATER QUALITY OF THE URBAN ARTIFICIAL SANDPIT LAKE 'SLOTERPLAS' AT AMSTERDAM,
Vrije Univ., Amsterdam (Netherlands). Inst. of Earth Sciences.
For primary bibliographic entry see Field 2H.
W79-07460

ESTIMATION OF THE CHANGES IN THE CHEMICAL COMPOSITION OF SURFACE WATER IN URBAN AREAS,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
B. G. Skakalski.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 334-338, 1977. 2 tab, 10 ref.

Descriptors: *Chemical properties, *Surface waters, *Estimating, *Urban areas, Effects, Urbanization, Water quality, Industrial wastes, Rivers, Water resources, Sewage, Urban drainage.

General problems of urban influences on the chemical composition of surface water are discussed. The main factors are described affecting the hydrochemical regime of natural water resources under urban conditions and the general tendency of the changes in the chemical composition of water within the urban area is analyzed. (See also W79-07426) (Bell Graf-Cornell)
W79-07462

SOURCES OF EUTROPHICATION IN THE WESTERN NETHERLANDS AS ILLUSTRATED FOR THREE POLDERS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
J. H. A. M. Steenvoorden.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality, Proceedings of the Amsterdam Symposium, October 1977. p 344-350, 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Science, 1 fig, 5 tab, 12 ref.

Descriptors: *Eutrophication, *Netherlands, *Polders, *Water pollution, Nitrogen, Phosphorus, Soils, Water balance, Equations, Effects, Mineral balance.

For three polders in the Western Netherlands, the contribution to the nitrogen and phosphorus loads from different sources of pollution was calculated. The fact that the land surface is below sea level and that heavy soil layers of eutrophic brackish peat are present cause a very high load of nitrogen and phosphorus. Horticultural use of the soils leads to a considerable additional loss of nitrogen compared with grassland. In quantitative terms, the most important contributors are: input of water from the River Rhine and incidental seepage, private gas wells, natural leaching of the peaty soil, and use of fertilizers in the horticultural areas. (See also W79-07426) (Bell Graf-Cornell)
W79-07464

METHODS OF FORECASTING THE ENTRY OF POLLUTANTS INTO URBAN WATER BODIES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
L. N. Falkovskaya-Chernysheva.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amerstdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 358-364, 1977. 1 fig, 6 ref.

Descriptors: *Forecasting, *Water bodies, *Urban, *Pollutant entry, Reliability, Water quality, Waste water(Pollution), Runoff, Methodology.

Forecasting water quality consists conventionally of two stages: (1) studying and assessing the influence of external factors on the processes affecting the quality of water; and (2) forecasting the quality of water in the water bodies for various calculation ranges. Discussed herein is predicting the amount of pollutants brought to surface-water bodies in urban areas by municipal and industrial waste water and overload flow from the area of cities. It is concluded that this is a very complex and many-faceted task; coping with the job means elaborating several scientific-technical and technological forecasts. The reliability of a pollution forecast depends to a considerable degree on the accuracy of intermediate forecasts, as well as on the dependability of input data. (See also W79-07426) (Bell Graf-Cornell)
W79-07466

THE MOVEMENT AND CHANGES IN CONCENTRATION OF CONTAMINANTS BELOW A SANITARY LANDFILL, PERTH, WESTERN AUSTRALIA,
Geological Survey of Western Australia, Perth.
For primary bibliographic entry see Field 5A.
W79-07468

MOBILITY OF POLLUTANTS IN SOIL AND GROUNDWATER NEAR WASTE DISPOSAL SITES,
Institute for Land and Water Management Research, Wageningen (Netherlands).
J. Hoeks.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 380-388, 1977. 6 fig, 1 tab, 12 ref.

Descriptors: *Groundwater, *Soils, *Pollutants, *Mobility, Waste disposal, Sites, Leachate, Equations, Chemical processes, Biochemical processes, Waste tips.

A considerable amount (50 to 60 per cent) of municipal refuse is dumped in or on the soil in the Netherlands. In the humid climate, the soluble components of the dumped refuse are leached into the underlying soil and groundwater. Leachate from a waste disposal site is a seriously polluted waste water. The flow path of these pollutants in soil is governed by the flow path of the carrier, i.e. water. This means that hydrogeological parameters determine the pathway of the pollutants through the groundwater towards the surface water. The mobility of the pollutants in soil largely depends on processes like cation exchange, chemical solubility equilibria and biochemical reactions. Cation exchange processes play an important role with respect to inorganic cations including heavy metals. Phosphates, carbonates and sulphides of iron, aluminum, calcium, magnesium and heavy metals are involved in chemical processes. Biochemical processes are important with respect to nitrogen compounds and organic substances. Information about the rate of these reactions is needed for predicting the mobility of different pollutants in the soil. To a certain extent, control of pollution is possible, e.g. by carefully selecting the sites for waste disposal, by controlling the infiltration of water into the dumped refuse and, if necessary, by collecting and treating the polluted leachate. (See also W79-07426) (Bell Graf-Cornell)
W79-07469

WATER QUALITY MODELS FOR WASTE WATER MANAGEMENT,
Australian National Univ., Canberra. Centre for Resource and Environmental Studies.
P. G. Whitehead.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 421-430, 1977. 6 fig, 12 ref.

Descriptors: *Water quality, *Model studies, *Waste water(Pollution), *Management, *Methodology, Evaluation, Effects, Effluents, Aquatic environment, Planning, Behavior, Time series analysis, Algorithms, Artificial aeration, Cam River(GB), Mass balance, Equations, Stochastic processes, Monte Carlo method, Simulation analysis, Systems analysis.

A methodology is proposed for evaluating the impact of effluent on the aquatic environment and for the development of management strategies for the planning and control of waste water systems. The particular approach considers the dynamic behavior of the river system and relates time varying upstream influents to downstream water quality using simple, low order but robust models of water quality. Identification and estimation problems are investigated using recursive algorithms of time series analysis, and practical applications are considered for an artificial aeration scheme on the River Cam and a probabilistic assessment of the impact of effluent from the new town of Milton Keynes in the United Kingdom. (See also W79-07426) (Bell Graf-Cornell)
W79-07472

5C. Effects Of Pollution

ECOLOGICAL ASSESSMENTS FOR WASTEWATER MANAGEMENT IN SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
T. G. Bahr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 121, Price codes: A19 in paper copy, A01 in microfiche. Report, 1972. 438 p, 32 fig, 55 tab, 437 ref, 2 append.

Descriptors: *Biological treatment, *Tertiary treatment, *Land management, *Michigan, *Lake Erie, Environmental effects, Ecosystems, Tributaries, River systems, Water quality control, Waste water treatment, Municipal wastes.

Detailed ecological consequences of advanced biological waste treatment, physical-chemical treatment, land disposal of wastes, and combinations of these treatments are described for Southern Michigan. To assist in the evaluation of waste management alternatives, an assessment methodology was developed and incorporated the assessment of depletion of potentially limiting resource reserves and the assessment of the impacts of energy utilization for a given waste water management alternative. The impacted areas studied were the sites for land disposal, the southeastern Michigan tributary system, and the Lake Erie system. Pollutants considered in the ecological evaluation included a variety of pesticides and other organic compounds, and heavy metals. The ecosystems of the impacted areas were also discussed. Phosphorus was identified as the primary pollutant affecting Lake Erie and phosphorus control was recommended. Improved methods of municipal and industrial waste water treatment would also improve the water quality of the tributary streams, especially in the area of outfalls. Appendices include a listing of heavy metals in southeastern Michigan and an evaluation of the impact of waste water on soils. (Lisk-FIRL)
W79-07041

LARVAL EXCLUSION SYSTEMS FOR POWER PLANT COOLING WATER INTAKES.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 024, Price codes: A11 in paper copy, A01 in microfiche. Proceedings of the Workshop held at San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. Sharma, R.K., and Palmer, J.B., (Eds.). 1978, 235 p. Argonne National Laboratory, Argonne, Illinois. DOE W-31-109-Eng-38.

Descriptors: *Environmental effects, *Entrainment, Fish, Larvae, Powerplants, Intakes, Cooling water, Design, *Impingement.

This workshop was cosponsored by Argonne National Laboratory, Electric Power Research Institute, and Southern California Edison Company. The objective of the workshop was to evaluate the status of various methods for prevention of larval fish entrainment. Concepts covered include: artificial filter beds; subsurface collectors; porous dikes; fine-mesh screens; perforated pipes; single-entrance, double-exit screens; and profile-wire screens. Nineteen papers are presented as well as a synthesis section. For most concepts, it was concluded that the demonstration of engineering feasibility is farther ahead than the demonstration of biological effectiveness. (See W79-07081 thru W79-07098) (Chilton-ORNL)
W79-07080

COOLING WATER INTAKES UTILIZING RANNEY COLLECTORS OR RANNEY INTAKES,
Ranney Method Western Corp., Kennewick, WA.
For primary bibliographic entry see Field 8I.
W79-07083

HYDROLOGIC ENGINEERING CONSIDERATIONS FOR RANNEY COLLECTOR WELL INTAKE SYSTEMS,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
For primary bibliographic entry see Field 8I.
W79-07084

AN ENGINEERING EVALUATION OF POROUS-DIKE INTAKE SCREENING SYSTEMS,
Worcester Polytechnic Inst. Holden, MA. Alden Research Lab.
For primary bibliographic entry see Field 8I.
W79-07085

BIOLOGICAL ASPECTS OF POROUS-DIKE INTAKE STRUCTURES,
New England Power Serice Co., Westborough, MA.
B. P. Schrader, and B. A. Ketschke.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diefo, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 51-63, 1978. 6 fig, 1 tab, 22 ref.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Filters, Aquatic life, Laboratory tests, On-site investigations, Intakes, Porous-dikes.

The porous dike being considered as a possible means of larval exclusion at power plant cooling water intakes resembles a breakwater but has a cobble or gravel core which allows relatively free passage of water while presenting a physical and behavioral barrier to aquatic organisms. Laboratory results and field observations suggest that avoidance by both larvae and post-larvae is likely, but design methods to maximize avoidance are not yet available. Fouling growth is a potential problem which has been avoided at existing dikes by the use of large filter materials. Methods are not yet available to predict flow restriction due to fouling. A three-year program of field experiments on a pilot-scale porous-dike is proposed to determine biological effectiveness. (See also W79-07080) (Chilton-ORNL)
W79-07086

ENGINEERING ASPECTS OF PASSAVANT SCREENING,
Passavant Corp., Birmingham, AL. Solids Disposal Div.
For primary bibliographic entry see Field 8I.
W79-07087

INVESTIGATION ON THE PROTECTION OF FISH LARVAE AT WATER INTAKES USING FINE-MESH SCREENING IMPINGEMENT-RELEASE CONCEPT: LABORATORY STUDY OF A SINGLE-ENTRANCE, DOUBLE-EXIT, VERTICAL TRAVELING SCREEN CONCEPT,
Tennessee Valley Authority, Chattanooga.
S. H. Magliente, D. A. Tomljanovich, J. H. Heuer, S. Vigander, and M. N. Smith.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 69-77, 1978. 6 fig, 4 ref.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Aquatic life, Intakes, Cooling water, Powerplants, Mortality, Filters, Screens, Larvae, *Impingement, Impingement-release.

The single-entry, double-exit vertical traveling screen which is described exhibits desirable characteristics for safe handling of fish and is amenable to design modification. The larval fish testing program underway will progress from an evaluation of fish survival on a basic screen with few modifications (worst case) to an evaluation of survival on a screen with several fish protection modifications. Upon completion of testing, survival of fish exposed to the entire impingement and transfer process will be compared to survival of fish exposed to impingement alone. Importance of stresses critical to larval survival will be investigated in the laboratory. (See also W79-07080) (Chilton-ORNL)
W79-07088

SURVIVAL OF DOMINANT ESTUARINE ORGANISMS IMPINGED ON FINE-MESH TRAVELING SCREENS AT THE BARNEY M. DAVIS POWER STATION,
Central Power and Light Co., Corpus Christi, TX.
L. S. Murray, and T. S. Jinnette.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 79-87, 1978. 3 fig, 3 tab, 5 ref.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Marine animals, Estuaries, Intakes, Cooling water, Powerplants, Mortality, *Impingement.

The purpose of this study was to describe survival of marine organisms impinged on Passavant fine-mesh center-flow traveling screens and to examine the influence of debris loading on survival of selected dominant species. During the twelve month study, overall percent survival of all organisms was 86%. Five species (Brevoortia patronus, Anchoa mitchilli, Micropogon undulatus, Penaeus aztecus, and Lucania parva) represented 80% of the total number and the fragile forms (Anchoa mitchilli and Brevoortia patronus) represented 58% of the total. Monthly catches were highly variable with the greatest numbers of dominant species collected from February through May and the fewest collected from June through December. Atlantic croaker and brown shrimp incurred only a 3% mortality while rainwater killifish and bay anchovy incurred the highest mortality at 31%. Some correlation was noted between debris loading and mortality during the study but it was concluded that mortality was increased more by the occurrence of jellyfish than any other factor. (See also W79-07080) (Chilton-ORNL)
W79-07089

CURRENT TVA WORK ON THE FLUID MECHANICS OF SCREENS WITH VERY SMALL OPENINGS FOR THE EXCLUSION OF LARVAE AT POWER PLANT COOLING-WATER INTAKES,
Tennessee Valley Authority, Norris. Div. of Water Management.
S. Vigander.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 91-105, 1978. 11 fig, 3 tab, 15 ref.

Descriptors: *Engineering structures, *Environmental effects, Intakes, Filters, Screens, Aquatic life, Powerplants, Cooling water, *Impingement.

Four specific problem areas involved in the use of screening media with very small openings are discussed: the prediction of pressure drop across a screen; estimation of pressure drop across partially plugged screens; rate of debris buildup on a site-specific stationary screen sample; and methods for stationary screen cleaning and their effectiveness. Various screen configurations are presented based on wire cross-sectional shape, weave type or method of assembly, mesh size on both surfaces and wirse size. Correlation between these parameters and pressure is discussed. Tests are currently underway on aspects of mechanical plugging of screens. So far these tests indicate no major problems. No tests have been made on biological fouling. (See also W79-07080) (Chilton-ORNL)
W79-07090

BIOLOGICAL AND ENGINEERING CONSIDERATIONS IN THE FINE-SCREENING OF SMALL ORGANISMS FROM COOLING WATER INTAKES,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8I.
W79-07091

INVESTIGATIONS ON THE PROTECTION OF FISH LARVAE AT WATER INTAKES USING FINE-MESH SCREENING,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
D. A. Tomljanovich, J. H. Heuer, and C. W. Voigtlander.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 125-139, 1978. 6 fig, 7 tab, 4 ref.

Descriptors: *Environmental effects, *Engineering structures, Intakes, Powerplants, Cooling water, Aquatic life, Larvae, Entrainment, *Impingement.

The objectives of this study were to determine the largest screen opening that would retain a high percentage of larval fish of several species representing a wide range of body shapes, to assess the influence of the velocity of approach water and the duration of impingement on percentage of fish retained, and to describe for each species the survival of the retained fish as a function of approach velocity and duration of impingement. Results showed that a 0.5 mm opening would be required to retain nearly all of the sizes and species of fish tested. Percentage retention was directly related to body depth. Velocity and impingement duration contributed little to percentage of retention. (See also W79-07080) (Chilton-ORNL)
W79-07092

THE JOHNSON SCREEN FOR COOLING WATER INTAKES,
Universal Oil Products, Inc., St. Paul, MN.
For primary bibliographic entry see Field 8I.
W79-07094

IN-SITU TESTING OF PROFILE WIRE SCREENS FOR LONG-TERM ENGINEERING FEASIBILITY,
Delmarva Power and Light Co., Wilmington, DE.
For primary bibliographic entry see Field 8I.
W79-07095

A STUDY ON THE PROTECTION OF FISH LARVAE AT WATER INTAKES USING WEDGE-WIRE SCREENS,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
J. H. Heuer, and D. A. Tomljanovich.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 169-194, 1978. 20 fig, 8 tab, 6 ref.

Descriptors: *Environmental effects, *Engineering structures, Powerplants, Intakes, Cooling water, Entrainment, Fish, Larvae.

This study was designed to estimate the ability of several species of larval fish to avoid impingement against and entrainment through a stationary slotted screen in flowing water. All species tested (Muskellunge, Channel catfish, Bluegill, Largemouth bass, Smallmouth bass, Striped bass, and Walleye) exhibited some ability to avoid entrainment. In general bypass or avoidance of entrainment was inversely related to slot size and slot velocity with best results being observed at 0.5-mm slot and 7.6 cm/s slot velocity. It was concluded that this screening concept has the potential for protecting most fish of impingeable size and many fish of entrainable size. (See also W79-07080) (Chilton-ORNL)
W79-07096

PRACTICALITY OF PROFILE-WIRE SCREEN IN REDUCING ENTRAINMENT AND IMPINGEMENT,
Ichthyological Associates, Inc., Middletown, DE. Delmarva Ecological Study.
B. N. Hanson, W. H. Bason, B. E. Beitz, and K. E. Charles.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66, p 195-233, 1978. 18 fig, 9 tab, 8 ref, 1 append.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Fish, Larvae, Intakes, Cooling water, Powerplants, *Impingement.

These studies were conducted to determine the expected entrainment and impingement of several species of fish, larvae and eggs by 1-mm-slot well screen intake. Observations showed that 1.01-mm slot profile-wire well screen operated at an intake velocity of 15.24 cm/s virtually eliminated impingement of fishes larger than 15 mm fork length. No impingement or stress occurred with fish less than 40 mm fork length held near an intake functioning at 15.24 cm/s for as long as 3 hours. Low impingement occurred at intake velocities as high as 53.34 cm/s. In preliminary egg mortality studies it was observed that at least 95% survival can be expected at approach velocities of 15.24 cm/s and impingement durations of up to 2 minutes. These studies are on-going and some have not progressed sufficiently to allow analyses. (See also W79-07080) (Chilton-ORNL)
W79-07097

LARVAL EXCLUSION SYSTEMS FOR POWER PLANT COOLING WATER INTAKES: A SYNTHESIS OF VIEWS PRESENTED AT THE WORKSHOP,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
For primary bibliographic entry see Field 8I.
W79-07098

VALIDATION AND SOFTWARE DOCUMENTATION OF THE ANL FISH-IMPINGEMENT MODEL,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
I. P. Murarka, D. J. Bodeau, and W. K. Derickson.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL-ES-62, Price codes: A06 in paper copy, A01 in microfiche. Report ANL/ES-62; April 1978. 124 p. 19 fig, 10 tab, 17 ref.

Descriptors: *Environmental effects, *Intakes, Powerplants, Cooling water, Fish, Model studies, *Impingement.

Results of a validation test of the ANL Fish Impingement Model are reported. 1974 fish-impingement and environmental data from the Zion Nuclear Power Station are used in the validation test. The test indicated that the modified and expanded mathematical model yields reasonable good results in calculations of daily fish-impingement losses at the cooling water intakes. Information on fish density and abundance is concluded to be the most important variable in the calculation of fish-impingement rates and it was therefore recommended that frequent determinations of fish density be made. It was concluded that the present mathematical model is adequate in view of the gross information available on fish factors relating to impingement and that further refinement of the model is not necessary until more quantitative data on the processes relating to fish abundance and impingement rate are developed. (Chilton-ORNL)
W79-07099

OPTIMUM WATER MANAGEMENT IN KAOLIN MINING FOR ALUMINUM PRODUCTION,
Georgia Inst. of Tech., Atlanta, GA.
For primary bibliographic entry see Field 6D.
W79-07129

NITRATE AND AMMONIUM CONCENTRATIONS OF GROUND WATER RESULTING FROM POULTRY MANURE APPLICATIONS,
Delaware Univ., Newark. Dept. of Plant Science.
W. C. Liebhardt, C. Golt, and J. Tupin.
Journal of Environmental Quality, Vol. 8, No. 2, p 211-215, April-June 1979. 2 fig, 4 tab, 18 ref.

Descriptors: *Groundwater, *Water pollution, *Farm wastes, *Poultry, Water quality, Leaching, Depth, Corn(Field), Fertilizers, Observation wells, Sampling, Groundwater movement, Crops, Ammonium salts, Nitrates, Soil nitrate, Nitrate dilution.

Large plots (0.402 ha) of Evesboro loamy sand received 0, 13, 27, 54, and 179 metric tons/ha of poultry manure in the spring of 1972, 1973, 1974, and 1975. Five wells were established in each plot at depths of 3, 4.5, and 6 m below the soil surface. In 1976, wells were established at 3- and 6-m depths in several other locations outside the plots. Corn was grown on these plots each year with no other additional fertilizer amendments. Water samples, taken regularly from these plots, showed that the concentration of nitrate at 3 m was affected by the application of poultry manure. At 4.5 and 6.0 m, the effect was not nearly as noticeable. There was a pronounced decrease in NO3-N concentration with increasing depth. The NO3-N concentration of water from some wells outside the plot area was quite high compared to the plot receiving no poultry manure, indicating that the source of the NO3-N in these well points was the poultry manure from treated plots. This suggested that the reduction in NO3-N at increasing depths under treated plots was partially a result of the lateral underground movement of nitrates. The concentration of NH4-N in the same water appeared to be only slightly affected, if at all. Application of poultry manure at rates higher than a crop can utilize results in nitrate movement through the soil profile and into the groundwater. (Visocky-ISWS)
W79-07156

CHANGES IN CONCENTRATIONS OF SELECTED CHEMICAL POLLUTANTS IN WET, TILE-DRAINED SOIL SYSTEMS AS INFLUENCED BY DISPOSAL OF SEPTIC TANK EFFLUENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. B. Reneau, Jr.
Journal of Environmental Quality, Vol. 8, No. 2, p 189-196, April-June 1979. 4 fig, 4 tab, 20 ref.

Descriptors: *Groundwater, *Pollutants, *Soils, *Tile drains, *Septic tanks, Phosphorus, Nitrogen compounds, Water table, Seasonal, Water pollution, Agriculture, Chemicals, Tile drainage, Effluents.

Changes in P, MBAS, NH4, NO3, NO2, Cl, pH, and Eh from septic effluent disposal were monitored in shallow groundwaters between septic effluent disposal fields and an agricultural tile drainage system in an area composed of Typic and Aeric Ochraquults. As effluent moved through the soil system toward the agricultural tile, P and MBAS decreased logarithmically with distance. As much as 87% of the observed variation could be attributed to distance for both P and MBAS. Phosphorus and MBAS in groundwaters intercepted by the tile drainage system at 2 of the sites had been reduced to acceptable levels. The concentrations of inorganic nitrogenous components in relation to the disposal area were similar at all 3 locations. The NH4-N concentration was highest adjacent to the drainfield (20-30 micrograms/ml) and decreased logarithmically with distance. A maximum of 83% of the observed decrease in NH4 could be attributed to distance. The NO3 concentration increased to a maximum at approximately 5 m and then decreased with increased distance. This was substantiated by the NO3/Cl ratios which indicated that NH4 was nitrified and the NO3 produced was subsequently denitrified to a large degree. The NO3 accumulation was seasonal, with the highest concentrations present during periods of rising water tables. (Visocky-ISWS)
W79-07157

AN INTRODUCTION TO THE LIMNOLOGY OF ROODEPLAAT DAM,
National Inst. for Water Research, Pretoria (South Africa).
R. D. Walmsley, D. F. Toerien, and D. J. Steyn.
Journal of the Limnological Society of South Africa, Vol. 4, No. 1, p 35-52, July 1978. 25 fig, 3 tab, 33 ref.

Descriptors: *Limnology, *Roodeplaat Dam(South Africa), *Impounded waters, *Eutrophication, Phytoplankton, Oxygen demand, Chemical stratification, Morphometry, Chemical properties, Bioassay, Biological properties, Physical properties, Thermal stratification, Nutrients, Sewage effluents.

Results are presented of certain physical, chemical, and biological observations made on the impoundment at Roodeplaat Dam north-east of Pretoria between February 1973 and May 1975. At each of five sampling stations water samples were collected from different depths at monthly intervals throughout the survey period. Roodeplaat Dam is a warm monomictic impoundment with stable thermal stratification during the summer when oxygen supersaturation of the surface waters and anaerobic conditions in the hympolimnion were encountered. The seasonal water transparency was related to existing phytoplankton populations and allochthonously-introduced clay material. Chemical stratification, prominent during summer, appeared to be caused by mineralization processes in the hypolimnion and by dilution in the surface layers during summer flooding. Considerable horizontal variation in most chemical and biological characteristics was found because of the morphology of the impoundment and the fact that sewage effluents are discharged into the major inflow. Roodeplaat Dam may be classified as a highly eutrophic water body on the basis of the nutrient content of the waters and the magnitude of the phytoplankton populations observed. (Davison-IPA)
W79-07186

OCCURRENCE AND SIGNIFICANCE OF CANDIDA ALBICANS IN LAKE ONTARIO BATHING BEACHES,
Canada Centre for Inland Waters, Burlington (Ontario).
J. P. Sherry, S. R. Kuchma, J. Zarzour, and B. J. Dutka.
Scientific Series No. 98, 1979, 31 p, 3 fig, 75 ref.

Descriptors: *Aquatic environment, *Acquatic bacteria, *Water pollution, *Pathogenic bacteria, *Coliforms, *Yeasts, Beaches, Aquatic microbiology, Methodology, Surveys, *Lake Ontario, *Candida albicans.

It has been established that the opportunistically pathogenic yeast C. albicans occurs in Lake Ontario beaches. The four beaches surveyed could be differentiated on the basis of bacterial fecal pollution indicator levels and numbers of the pathogens C. albicans and Pseudomonas aeruginosa. The occurrence of the two pathogens in the beach waters examined appears to be related to elevated fecal pollution indicator levels. Maximum numbers of all microbial parameters were observed in July and August in association with peak bather loads at the beaches. Where microbial population levels were adequate, a decreasing distribution pattern from the shoreline to the offshore waters was observed. In only one instance does the data suggest that a beach had been subjected to human fecal contamination. Storm water runoff is the most plausible source of the contamination in most other cases, although the possibility that the bathers themselves may contribute to the pollution level of a beach must also be considered. (WATDOC)
W79-07207

WASTEWATER GENERATION AND DISPOSAL IN VENEER AND PLYWOOD PLANTS IN BRITISH COLUMBIA,
Environmental Protection Service, Vancouver (Ontario). Pacific Region.
R. G. Thompson.
Economic and Technical Review Report EPS 3-WP-78-7, June 1978, 28 p, 1 fig, 8 tab, 4 ref, 1 append.

Descriptors: *Wood wastes, *Waste water treatment, *Waste water disposal, *Waste water(Pollution), Industrial plants, Toxicity, Fish, Effluents, Resins, Phenols, Analysis, *British Columbia.

This investigation was carried out to characterize the wastewater from British Columbia plywood and veneer plants; to examine in plant operations that generate wastewater; and to document wastewater disposal and treatment procedures that are being used within the industry. The data obtained indicate that all wastewater generated by the plywood and veneer operations is toxic to fish at low effluent concentrations and that this toxicity increases with increased resin acid and phenolic content of the effluent. (WATDOC)
W79-07214

THE EFFECT OF ACID MINE DRAINAGE WATER ON TWO PENNSYLVANIA SOILS,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
E. J. Ciolkosz, L. T. Kardos, and W. F. Beers.
Soil Science, Vol. 127, No. 2, p 102-107, Feb. 1979. 2 tab, 16 ref. OWRT B-086-PA(2). 14-34-0001-6114.

Descriptors: *Acid mine water, Soil chemistry, Silicates, Water pollution effects, Soil water, Iron, Aluminum, Calcium, Hydrogen ion concentration, Pennsylvania.

The effects of acid water on soil material are discussed. Two Pennsylvania soils, Rayne and Guernsey, which had had 525 cm of acid mine water passed through, were analyzed. Lowered were the pH, calcium content, and percent base saturation of the soil material, with soil's CEC, acidity, iron and aluminum contents increased. The increase in aluminum and iron contents was much greater than was the amount of aluminum and iron added by the acid water. Thus, the acid treatments mobilized some native soil aluminum and iron in the treated soil; these same treatments also created some new CEC sites. Phosphorus data showed a depletion of phosphorus in the Rayne and a redistribution of phosphorus downward in the Guernsey. Little or no change in particle size distribution and clay mineralogy occurred as a result of the treatment. The various effects of acid water on soil materials were the greatest in the upper parts of the soil. The responses of the two Pennsylvaina soils to prolonged leaching with acid mine water were very different in magnitude but similar in direction of change of the various chemical parameters. (Tsong-Penn State)

W79-07251

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME I,
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 650 p. AA550-CT7-11.

Descriptors: *Environmental effects, *Baseline studies, *Resources development, *Texas, Water pollution effects, Ecosystems, Biology, Chemistry, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. The studies constituted the third year of a sampling program of chemical and biological parameters of the STOCS. The resultant data from this investigation represent the first step in understanding how to assess and control the impact of petroleum exploration and development in the STOCS area. The central goal of these and other environmental quality survey of continental shelf areas is the protection of the living marine resources from deleterious effects. This is the first volume of six volumes and individual studies are separately abstracted. (See also W79-07288 thru W79-07297) (Sinha-OEIS)
W79-07287

INTRODUCTION.
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol I,' p 1-1 - 1-31, January 15, 1979. 4 fig, 10 tab. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Environmental effects, *Ecosystems, *Water pollution effects, Sampling, Variability, Resources development, Exploration, Texas, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

The Texas coastal area is biologically and chemically a two part marine system, the coastal estuaries and the broad continental shelf. These two components of the marine systems are separated by barrier islands and connected by inlets or passes. The STOCS study area corresponds to the area outlined by the Department of the Interior for oil and gas leasing. The broad objectives of the 1977 study effort of the STOCS area was to continue describing the natural temporal and spatial variability of all major components of the OCS marine ecosystem. It was assumed that understanding the natural inherent variability of this ecosystem would contribute immensely to evaluating potential impact to the environment from unnatural perturbations such as oil and gas exploration and production. Samples were collected in 1977 during three biological-meteorological seasons from all transects and four of the bank stations. The sampling effort was broken up into four types of sampling: water column, benthos, histopathology and microbiology. A number of publications and presentations have resulted from the 1975-77 STOCS studies. These, along with works in progress, are presented in a table. (See also W79-07287) (Sinha-OEIS)
W79-07288

HIGH-MOLECULAR-WEIGHT HYDROCARBONS IN ZOOPLANKTON, SEDIMENT AND WATER: TOTAL ORGANIC CARBON AND DELTA C13 IN SEDIMENT: SUMMARY OF HIGH-MOLECULAR-WEIGHT HYDROCARBON ANALYSES CARRIED OUT IN SUPPORT OF THE MICROBIOLOGY PROJECT AND THE TOPO-HIGH PROGRAM,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5B.
W79-07291

TRACE METALS IN EPIFAUNA, ZOOPLANKTON AND MACRONEKTON,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W79-07293

WATER COLUMN BACTERIOLOGY,
Texas Univ., San Antonio. Div. of Allied Health and Life Sciences.
H. V. Oujesky, O. W. Van Auken, J. Allen, W. Brooks, and A. Kaster.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol I,' p 8-1 - 8-128, January 15, 1979. 64 fig, 27 tab, 19 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Bacteria, *Water quality, *Biodegradation, *Oil pollution, Microbial degradation, Water pollution effects, Environmental effects, Nutrients, Ecosystems, Seasonal, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

The 1977 water column bacteriology studies were initiated as a part of the South Texas Outer Continental Shelf (STOCS) program to identify and to quantitate the heterotrophic and hydrocarbonoclastic microbial populations; to determine the oil degradation potential of the hydrocarbonoclastic bacteria; to study the ecological succession of mixed bacterial cultures in the presence of oil; and to study the effects of different nutrients on metabolic activities of pure and mixed bacterial cultures. A total of 1,905 marine bacteria were isolated from the samples and 1,631 generic identifications have been completed at this time. Fourteen genera were represented by the isolates. Acinetobacter, Aeromonas, Alcaligenes, Flavobacterium, Pseudomonas, and Vibrio were the only hydrocarbonoclastic genera isolated from any of the three stations. They were also prevalent in the heterotrophic bacterial isolates. The highest percentage of oil degraders occurred in July and August when the heterotrophic population was decreased somewhat and the hydrocarbonoclastic populations were increased. In the winter season, the decreases in populations offshore was more pronounced. The nutrient experiments showed that addition of nitrogen, phosphate, and iron, or a complete mineral salts medium significantly enhanced hydrocarbon metabolism. (See also W79-07287) (Sinha-OEIS)
W79-07295

WATER COLUMN AND BENTHIC MICROBIOLOGY-MYCOLOGY,
Texas Univ. at Austin. Dept. of Microbiology.
P. J. Szaniszlo, R. F. Davenport, P. A. Geis, R. L. Hebert, and D. G. Kennedy.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol I,' p 9-1 - 9-67, January 15, 1979. 13 fig, 11 tab, 85 ref. Texas University Marine Sciences Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Microbiology, *Fungi, *Benthos, *Biodegradation, Water pollution effects, Oil pollution, Texas, Resources development, Environmental effects, Seasonal, *Outer Continental Shelf, Mycology, Crude oil, Petroleum hydrocarbons, Mycota, South Texas Outer Continental Shelf(STOCS).

Water samples were collected at three stations during six monthly cruises. Bottom sediment samples were collected at six stations during three seasonal cruises. Sediments were diluted and water samples concentrated before plating on hydrocarbonoclastic selective and nonselective media for fungal enumeration. Sediment and water samples were overlaid with crude oil and sampled periodically to determine the effects of oil on the fungi. Upon termination of the experiments, the alkane and aromatic fractions of residual oils were analyzed to evaluate the degradation potential of each sample and the preferential degradation of individual oil components. Similar studies were conducted on fungi in pure culture. Several hundred isolates were tested for their ability to grow on crude oil as a sole source of carbon and energy. The numbers of total fungi in the water column were uniformly distributed and mcuh more abundant in spring than later in the year, but the percentage of oil-degraders increased offshore and throughout the year. Total benthic fungi increased from spring to fall. Fungal n-alkane degradation potentials of benthic and water samples tended to decrease offshore across the shelf especially during the summer. Degradation was greatly increased in the presence of river outwash. Intermediate length n-alkanes were preferentially utilized by fungi but isoalkanes were recalcitrant. Crude oil was initially toxic to the petroleum-degrading fungi but in general served to stimulate fungal growth after a period of one to several weeks. (See also W79-07287) (Sinha-OEIS)
W79-07296

BENTHIC BACTERIOLOGY,
Texas A and M Univ., College Station. Dept. of Marine Biology.
J. R. Schwarz, S. K. Alexander, V. L. Carpenter, S. Schropp, and J. C. Clary, III.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol I,' p 10-1 - 10-31, January 15, 1979. 9 fig, 4 tab, 26 ref. Texas University Marine Sciences Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline sgudies, *Bacteria, *Microbial degradation, *Biodegradation, Oil pollution, Water pollution effects, Environmental effects, Texas, Resources development, Sediments, *Outer Continental Shelf, *Hydrocarbons, Petroleum hydrocarbons, Pseudomonas, Bacillus, Vibrio, South Texas Outer Continental Shelf(STOCS).

Selected characteristics of benthic bacteria of the South Texas Outer Continental Shelf (STOCS) were measured. The percentage of bacteria in the population able to degrade hydrocarbons was from 0.10 to 20.68%. Bacterial populations exhibited both seasonal and spatial variations. The predominant genera of aerobic heterotrophic bacteria were Bacillus, Vibrio and Pseudomonas. Hydrocarbon degrading bacteria were predominantly species of Pseudomonas. Oil biodegradation by natural sediment populations ranged from 0 to 91.6%. Low molecular weight n-paraffins were utilized to a greater extent than high molecular weight paraffins. Degradation rates exhibited seasonal variations, but were evenly distributed geographically. The addition of oil to sediment increased bacterial populations, and changed the composition of the population to one more capable of degrading oil. (See also W79-07287) (Sinha-OEIS)
W79-07297

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME II,
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 603 p. AA550-CT7-11.

Descriptors: *Environmental effects, *Baseline studies, *Resources development, *Texas, Water pollution effects, Ecosystems, Biology, Chemistry, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. The studies constituted the third year of a sampling program of chemical and biological parameters of the STOCS area. The central goal of these and other environmental quality surveys of continental shelf areas is the protection of the living marine resources from deleterious effects. This is the second volume of six volumes and individual studies are separately abstracted. (See also W79-07299 thru W79-07309) (Sinha-OEIS)
W79-07298

PHYTOPLANKTON AND PRODUCTIVITY,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
D. Kamykowski, C. Van Baalen, J. Batterton, J.

Bird, and S. Anderson.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 11-1 - 11-57, January 15, 1979. 30 fig, 8 tab, 9 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Phytoplankton, *Productivity, *Chlorophyll, Texas, Temperature, Salinity, Environmental effects, Water pollution effects, Resources development, *Outer Continental Shelf, *Light extinction, Carbon uptake, Skeletonema costatum, South Texas Outer Continental Shelf(STOCS).

The 1977 phytoplankton and productivity studies consisted of (1) water column light extinction measurements; (2) phytoplankton species counts; (3) chlorophyll a determinations; (4) carbon uptake determinations; and (5) continuous measurement of surface chlorophyll a, temperature and salinity along Transect II. General methods for 2, 3 and 4 are presented in flow charts. Secchi depth generally increased offshore except when unusual interdigitation of turbid and clear water coincided with station samples. Biomass generally decreased offshore both as chlorophyll a concentration and cell numbers. The nanno-fraction dominated the chlorophyll a values. The diatoms dominated inshore while the coccolithophorids dominated offshore. Carbon uptake paralleled the biomass patterns, but were less variable across the shelf. Depth profiles identified variable vertical structure during the seasonal cruises. The nanno-fraction dominated the water column at all depths especially in spring and fall. The interrelationships among Secchi depth, phytoplankton abundances, and chlorophyll a were good. Carbon uptake was anomalously high during May. A distinction can be made between the effect of Mississippi River water and more local run-off. (See also W79-07298) (Sinha-OEIS)
W79-07299

SHELLED MICROZOOPLANKTON AND GENERAL MICROPLANKTON,
Rice Univ., Houston, TX. Dept. of Geology.
R. E. Casey, K. J. McMillen, J. Gervitz, R. Schwarzer, and A. Leavesly.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 12-1 - 12-46, January 15, 1979. 19 fig, 3 tab, 7 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, Zooplankton, *Upwelling, *Data analysis, Monitoring, Seasonal, Texas, Resources development, Water pollution effects, Environmental effects, *Outer Continental Shelf, Radiolara, Globigerina, South Texas Outer Continental Shelf(STOCS).

Depth stratified Nansen net tows and discrete depth Niskin bottle samples were collected in the BLM-STOCS study are seasonally and during July, August, November and December of 1977. Shelled microzooplankton and general microplankton were studied from the Nansen nets and Niskin bottles respectively. The shelled microzooplankton and general microplankton data were compared to the physical oceanography of the study area by use of density, diversity and other plots of the data along with cluster analysis. These comparisons revealed: ponds of water moving onto the shelf at various depths during the winter; strong upwelling in the winter and into the spring; brackish water moving out toward the open Gulf of Mexico in the spring drawing deeper open Gulf water shoreward underneath it; and, a dramatic eutrophism of the STOCS during the winter and into the spring of 1977. These conclusions were suggested by certain observed species of shelled microzooplankton that indicate the above oceanographic conditions. (See also W79-07298) (Sinha-OEIS)
W79-07300

CILIATED PROTOZOA,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
P. L. Johansen.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 13-1 - 13-40, January 15, 1979. 14 fig, 4 tab, 21 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Protozoa, *Plankton, *Foodwebs, Texas, Water pollution effects, Environmental effects, Biomass, Resources development, *Outer Continental Shelf, *Ciliated protozoa, South Texas Outer Continental Shelf(STOCS).

During 1977, 108 one-liter samples were collected from the STOCS. These samples, which were preserved with 1% basic Lugol's fixative, were analyzed for ciliated protozoa using the Utermohl (1931) method. Of the 86 protozoan species observed, 49 were tintinnids, 10 were oligotrichs, 5 were foraminifera, 10 were radiolarian/acantharia and 12 were 'other' protozoa. Protozoa reached an abundance maximum in early spring (March-April). There was a second abundance peak in September which was thought to be abnormal and a result of Hurricane Anita, which passed through the area at that time. Oligotrichs were the most dominant group of protozoa on the STOCS. They were uniquitous and abundant both spatially and temporally. The other protozoan groups tended to be less abundant and more restricted in space and time. Protozoan biomass ranged from 1 to 348% of the macrozooplankton biomass, indicating that the protozoa are a significant component of the zooplankton community. Correlations with temperature, salinity, dissolved oxygen, netphytoplankton, nitrate and phosphate were not significant but the salinity relationship with protozoans was negative suggesting a possible ecological relationship. (See also W79-07298) (Sinha-OEIS)
W79-07301

ZOOPLANKTON PROJECT,
Texas A and M Univ., College Station. Dept. of Marine Biology.
E. T. Park, P. Turk, P. Jones, M. Valentine, and M. Kaneps.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 14-1 - 14-58, January 15, 1979. 4 fig, 25 tab. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Zooplankton, Seasonal, Sampling, Texas, Oil pollution, Metals, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Hydrocarbons, Petroleum development, Copepoda, Ostracoda, Amphipoda, Cnidaria, Mollusca, Chaetognatha, Larvacea, Cladocera, South Texas Outer Continental Shelf(STOCS).

Significant findings of the third year (1977) of zooplankton studies on the South Texas Outer Continental Shelf are detailed. When grouped by depth related stations, transects and seasons, the data show many of the trends observed in past years. The best represented major taxa were Copepoda, Ostracoda, Amphipoda, Cnidaria, Mollusca, Chaetognatha, Larvacea and Cladocera. Ostracods rivaled the copepods in abundance, especially during the winter and spring. Cladocera and Mollusca were most abundant in the spring at nearshore stations. Amphipoda, Cnidaria, Chaetognatha and Larvacea occurred in moderate numbers throughout the area and their numbers were generally greatest in the spring. Changes in temperature, salinity and chlorophyll a values showed some correlation with changes in zooplankton abundances. The maximum abundances of zooplankton occurred at nearshore stations in the spring when temperatures were in the upper half of their annual range and salinities were at their yearly low. In general, zooplankton abundances were highest at stations where chlorophyll a values were highest during each season. In addition to the normal sampling design, a sample was also collected at each station for taxonomic enumeration in conjunction with the trace metals and hydrocarbon sampling programs for zooplankton body burdens. (See also W79-07298) (Sinha-OEIS)
W79-07302

NEUSTON PROJECT,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. H. Wormuth, L. H. Pequegnat, McEachran, A. Hart, and J. Cummings.
In: 'Environmental Studies, South Texas Outer Continental Shelf. Biology and Chemistry, Vol II,' p 15-1 - 15-66, January 15, 1979. 39 fig, 5 tab, 12 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Taxonomy, *Ecosystems, Texas, Water pollution effects, Environmental effects, Oil pollution, Gases, Resources development, Larvae, *Outer Continental Shelf, *Neuston, Air-sea mixing, Petroleum development, South Texas Outer Continental Shelf(STOCS).

Neuston samples were collected on nine cruises on the South Texas Outer Continental Shelf (STOCS) during 1977. The samples were analyzed taxonomically and for standing crop and tar values. The taxonomic analysis of the neuston community occupying the upper 15-20 cm of the water column at specified locations included quantitative enumeration of species, dry weight and ash-free dry weight determinations and weight of tar, and was designed to characterize existing environmental conditions prior to possible environmental perturbations which might occur in the future as a result of offshore drilling for oil and gas. The neuston environment and its organisms are important to the water column ecosystem in that they occupy a relatively thin skin of the ocean surface where air-sea mixing initially occurs. Many potential pollutants are thought to enter the oceans through this route, and any biological impact might first manifest itself in changes in the neuston. (See also W79-07298) (Sinha-OEIS)
W79-07303

MEIOFAUNA PROJECT,
Texas A and M Univ., College Station. Dept. of Oceanography.
W. E. Pequegnat, and W. B. Sikora.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 16-1 - 16-34, January 15, 1979. 5 fig, 11 tab, 43 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Nematodes, *Sediments, *Oil pollution, Texas, Environmental effects, Water pollution effects, Resources development, Gases, *Outer Continental Shelf, *Meiofauna, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A total of 540 sediment samples collected between February and December 1977 from 25 transect stations and four bank stations on the South Texas Outer Continental Shelf (STOCS) were analyzed for establishment of meiofaunal populations and communities. The major objective of this investigation was to determine in a relatively small geographical area of the STOCS area, including two hard banks, the distributions, abundances, and environment of the taxonomic components of the meiofauna. These findings will play a significant role in formulation of natural conditions from which it should be possible for environmental managers to determine whether or not man's activities on the shelf are having impacts of concern on the fauna. The meiofauna can provide data and concepts that will be useful in judging the impacts of sedimental and other environmental changes that will result from discovery and production of oil and gas. (See also W79-07298) (Sinha-OEIS)
W79-07304

BENTHIC INVERTEBRATES: MACROINFAUNA AND EPIFAUNA,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
J. S. Holland, S. Cornelius, A. Dixon, J. Holt, and S. Holt.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 17-1 - 17-56, January 15, 1979. 13 fig, 6 tab, 16 ref. Texas University Marine Science Institute

Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Invertebrates, *Benthos, *Seasonal, *Data analysis, Texas, Environmental effects, Water pollution effects, Resources development, *Outer Continental Shelf, Species distribution, Petroleum development, South Texas Outer Continental Shelf(STOCS).

The third year of data collection on the South Texas Outer Continental Shelf (STOCS) benthic invertebrate study consisted of 450 samples of benthic infauna and 186 epifaunal samples collected seasonally on four transects. Infaunal data was analyzed for community structural parameters, for station and species groupings and station groups so identified were verified by use of discriminant analysis. Epifaunal data were analyzed for community structural parameters, for station and species groupings and for individual species distribution patterns by linear correlations and multivariate analyses. Single effect correlation coefficients of seven environmental parameters with the distribution of major species within each species group are presented as are linear additive models for distribution of species thought to be representative of various species groups. (See also W79-07298) (Sinha-OEIS)
W79-07305

DEMERSAL FISHES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
D. E. Wohlschlag, R. M. Yoshiyama, M. Dobbs, and E. Findley.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 18-1 - 18-99, January 15, 1979. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Fishes, *Benthos, Data analysis, Water pollution effects, Environmental effects, Texas, Resources development, *Outer Continental Shelf, *Demersal fish, Lutjanus, Syacium, South Texas Outer Continental Shelf(STOCS).

The collection and analysis of samples of benthic fishes on the South Texas Outer Continental Shelf (STOCS) was continued for the third consecutive year. Data on relative abundances, gross distribution patterns and average catches for selected species are summarized. A brief comparison of the data contained in this report with data from the previous year (1976) was made. Correlative patterns between selected environmental parameters and several species were examined. The use of such patterns serves to identify the environmental variables of importance to demersal fishes and also represents a starting point for the development of a predictive capability for abundances of benthic fishes based on knowledge of environmental conditions. (See also W79-07298) (Sinha-OEIS)
W79-07306

HISTOPATHOLOGY OF DEMERSAL FISHES,
Texas A and M Univ., College Station. Dept. of Veterinary Anatomy.
W. E. Haensly, and J. C. Eurell.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 19-1 - 19-32, January 15, 1979. 17 tab, 1 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Fishes, *Parasitism, *Environmental effects, Texas, Water pollution effects, Resources development, *Outer Continental Shelf, *Histopathology, Demersal fishes, South Texas Outer Continental Shelf(STOCS).

Histopathologic analyses of 15 species of demersal fishes were made. Samples were collected during nine cruises: three seasonal (February, June and October) and six monthly (March, April, July, August, November and December). The organ sampling effort included heart, stomach, kidney, muscle and liver. Organ samples were prepared for hisotologic examination by routine histologic procedures. Parasitism, both protozoan and helminthic, was the primary cause of lesions in all organs. Lesions consisted of free and encapsulated parasites with varying degrees of inflammation and necrosis. The integrity of the tissues adjacent to the lesions was maintained. Quantitative analysis of the percentages of lesions between and within various groups demonstrated that the lesions of stomach and liver were significantly more frequent throughout the study than were those of kidney, muscle and heart, while kidney lesions occurred with significantly greater frequency than did heart and muscle lesions. Cardiac lesions were significantly more frequent in the vermilion snapper (Rhomboplites aurorubens) and the red snapper (Lutjanus campechanus) than in the 13 other species. Lesion percentages that did not differ significantly were as follows: between species, except between red snapper and Atlantic threadfin (Polydactylus octonemus); between cruises within stations; between stations; between cruises within seasonal effort; between cruises within monthly effort; and between seasonal and monthly cruises. (See also W79-07298) (Sinha-OEIS)
W79-07307

HISTOPATHOLOGY OF INVERTEBRATE EPIFAUNA,
Texas A and M Univ., College Station. Dept. of Biology.
J. M. Neff, and V. V. Ernst.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 20-1 - 20-44, January 15, 1979. 15 tab, 16 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Pathology, *Invertebrates, *Monitoring, Texas, Crabs, Shrimps, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Histopathology, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A histopathological study of epifaunal invertebrates was carried out on 2265 organs from 453 specimens. The total number of pathologies in the gills almost equaled that in internal organs. Shrimp had the highest percent and variety of symbionts in the gills, most of which were parasitic ciliates. The total percent of other types of pathological conditions in the gills was higher than the total percent of symbionts. Crabs had by far the largest number of such conditions and molluscs had very few gill pathologies of any kind. All pathological conditions other than symbionts in the gills and internal organs could have been caused by parasites, bacteria, viruses or injuries. Most of these conditions in the internal organs, however, appeared to be related to the host's reaction to parasites. The largest percent of all pathologies in the internal organs were found in the gastro-intestinal tract of the animals studied. The purpose of this study was the continuation of the development of a data base of hitopathologies of invertebrate epifauna of the STOCS area. Such a study is necessary for environmental monitoring purposes, as such surveys have not been performed previously. Some pathological conditions were shown to differ with change in seasons and some were found only at certain depths of the Gulf. (See also W79-07298) (Sinha-OEIS)
W79-07308

REPRODUCTIVE CYCLE, HISTOLOGICAL-HISTOPATHOLOGICAL SURVEY OF GONADAL TISSUE AND KARYOTYPE ANALYSIS OF SELECTED SPECIES OF MACROEPIFAUNA AND DEMERSAL FISHES,
Texas Univ. Health Science Center at San Antonio. Div. of Allied Health and Life Sciences.
S. A. Ramirez, J. W. Zeagler, L. Landry, Jr., and S. D. Walker.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry, Vol II,' p 21-1 - 21-68, January 15, 1979. 10 fig, 30 tab, 46 ref. Texas University Marine Science Institute Final Report 1977. AA550-CT7-11.

Descriptors: *Baseline studies, *Fishes, *Invertebrates, *Pathology, *Reproduction, Texas, Environmental effects, Shellfish, Monitoring, Resources development, Water pollution effects, *Outer Continental Shelf, Chromosomal aberrations, Petroleum development, South Texas Outer Continental Shelf(STOCS).

The histological-histopathological characterization study of the macroepifauna and demersal fishes of the STOCS was initiated in the summer of 1976 and continued through 1977. Physiological conditions and pathological changes and/or occurrences were monitored and catalogued. This study consisted of the survey of (1) vertebrate and invertebrate gonads; and (2) karyotype analyses of vertebrate and invertebrate species. The purpose of this portion of the histopathological effort was threefold: first, to establish the normal seasonal (physiological) changes in the histology of the male and female gonads; second, to examine the gonads for pathological conditions; and third, to develop methodology for karyological analysis and establish karyotypes for marine organisms. Seasonal changes (reproductive cycle) in the histology of the gonads were only partially established. A number of pathological conditions were found in these tissues, but the incidence of pathology in the gonads was only 16.9%. Chromosomal counts and karyotypes were established for some invertebrates and fishes to provide a basis for future monitoring for chromosomal aberrations. (See also W79-07298) (Sinha-OEIS)
W79-07309

BIOLOGICAL RELEASE AND RECYCLING OF TOXIC METALS FROM LAKE AND RIVER SEDIMENTS,
Australian National Univ., Canberra. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-07346

EUTROPHICATION OF FOUR TRANSVAAL DAMS,
National Inst. for Water Research, Pretoria (South Africa).
R. D. Walmsley, D. F. Toerien, and D. J. Steyn.
Water S. A., Vol. 4, No. 2, p 61-75, April 1978. 13 fig, 6 tab, 22 ref.

Descriptors: *Eutrophication, *Nutrients, *Impounded waters, *Chemical analysis, *Bioassay, Conductivity, Phosphorus, Nitrogen, Sewage, Industrial wastes, Effluents, Dams, Impoundments, Bufflespoort Dam, Hartbeespoort Dam, Rietvlei Dam, Roodeplaat Dam(Transvaal).

Sources of eutrophying elements were detected by chemical analyses and algal bioassays in a two year study of river waters in the catchment areas of the Bufflesport, Hartbeespoort, Rietvlei, and Roodeplaat Dams. Although the analysis of water samples included determination of other elements, only the results for phosphorus and nitrogen are discussed, because they are the most important elements of eutrophication. Mean values for conductivity, phosphate, and the combined forms of nitrogen are presented for waters obtained from each of the four catchment areas. The main cause of eutrophication of the Hartbeespoort, Rietvlei, and Roodeplaat Dams are sewage and industrial effluents; eutrophication of the Bufflespoort Dam is due to natural activities. The Vollenweider nutrient loading concept model is discussed with regard to the conditions existing at these impoundmets during the study period. This concept, based on the fact that deep lakes with short residence times tolerate higher loading rates than shallow lakes with long residence times, has allowed prediction of the threshold phosphorus loading rate above which eutrophication problems may occur. It is concluded that determination of nutrient loading rates for important water bodies in South Africa is prerequisite to establishing guidelines for eutrophication control. (Davison-IPA)
W79-07364

STUDY OF THE CUMULATIVE GROWTH-INHIBITING FACTORS IN RECYCLED WATER FOR CATFISH CULTIVATION,
Arkansas Univ., Fayetteville. Arkansas Water Resources Research Center.
R. W. Raible.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 117, Price codes: A03 in paper copy, A01 in microfiche. Publication No. 64, April 1979. 44 p, 10 fig, 8 tab. OWRT A-038-ARK(1).

Descriptors: *Water pollution effects, *Fish physiology, *Channel catfish, Growth rates, Environmental effects, Water reuse, Recirculated water, Metabolism, Filters, Water pollution, Water quality, Feeding rates.

Research is reported to determine whether recycled water used in the cultivation of channel catfish in closed systems accumulates catfish growth inhibiting factors. Channel catfish were grown in eight closed water-recirculating systems with individual biological filters. Tests were made of extractions of the tank water taken 120 days after fish occupation began, and repeated every 30 days for 360 days. Heartbeat rates were determined 15 minutes after sample injection by counting pulses visually from the strip chart record. It was found that the samples extracted from the closed systems consistently caused a reduction in the heartbeat rate of approximately 20% in fresh pond-raised specimen catfish. After 120 days the increased ammonia levels required reduction of the feeding rate, so that weight gain was reduced and cannibalism increased. It is thought that this metabolic disturbance is a factor in reducing the growth rate of fish closely confined in recirculating systems. (Davison-IPA)
W79-07366

EFFECTS OF INCREASES IN CARBON DIOXIDE IN THE EARTH'S ATMOSPHERE - A SYNTHESIS,
Biospherics Inc., Rockville, MD.
S. Smith.
NOAA, Environmental Data and Information Service, Report, February 1979. 15 p, 46 ref.

Descriptors: *Carbon dioxide, *Atmosphere, *Environmental effects, Weather, Ecology, Water temperature, Oceans, Sea level, Pollution, Global climate.

If left unchecked, increasing levels of CO2 may eventually have far-reaching consequences on a global scale. Many scientists forecast a CO2-dependent increase in temperature, with concomitant effects on weather, climate, terrestrial and marine ecology, and other dimensions of the environment. These changes may have serious implications for human industrial activities such as agriculture, fishing, and energy production and use. More research is needed to define the problem and to pinpoint the decisionmaking time frame before the problem becomes unsolvable. To reduce uncertainties and to assess the seriousness of the matter, scientists point to the need for a well-coordinated, interdisciplinary, international program. Practical ways of reducing the CO2 content of the air, either by direct removal from the air or by 'scrubbing' the effluent of powerplants, should also be investigated. The effects of continued increases in atmospheric CO2 may have implications for many diverse aspects of national and international policy. If the issue is ignored, CO2, until now a seemingly harmless trace component of the atmosphere, could eventually exert profound influences. (NOAA)
W79-07371

CHANGES IN WATER QUALITY IN THE NETHERLANDS DURING THE LAST CENTURY RESULTING FROM THE ACTIVITIES OF MAN,
Institute TNO for Environmental Hygiene, Delft (Netherlands).
M. A. de Ruiter.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 241-251, 1977. 6 fig, 7 tab, 12 ref.

Descriptors: *Water quality, *Surface waters, *Effects, *Netherlands, Regional analysis, Geological history, Hydrological history, Natural quality, Rainwater, Lakes, Rivers, Rhine River(Netherlands), Eutrophication, Oligotrophy.

During the last century, the Netherlands has changed from an agricultural society of 3 million inhabitants to an industrial society of 13.7 million. Fertilization, mechanization and imports of animal foodstuffs have multiplied agricultural production. All these factors have influenced the quality of the surface waters, intensified by similar developments in other countries bordering the rivers Rhine, Meuse and Scheldt. To define these influences it is important to know the water quality a century ago. A rough idea about this 'natural quality is obtained by dividing the country into two regions: The east and southeast--mostly higher ground of Pleistocene sands not influenced by the sea; and the west and north--the lower Holocene peat and clay regions, influenced by the sea. The natural water quality of the first region is oligotrophic, poor in nutrients, while the second region is eutrophic. Indications of the water quality 20 to 100 years ago support this rough sketch. From recent quality data, it seems that some waters on the higher grounds have preserved their oligotrophic quality, in spite of the influence of air pollution on precipitation. Data for the Rhine, collected for over a century, indicate the changes in water quality of this river. (See also W79-07426) (Bell Graf-Cornell)
W79-07452

THE POLLUTION OF WATER RESOURCES DUE TO RURAL INDUSTRIAL WASTE,
Roorkee Univ. (India). School of Hydrology.
B. S. Mathur.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October, 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 311-314, 1977. 2 fig.

Descriptors: *Water pollution, *Industrial wastes, *Effects, *Sugar industry, Surface waters, Groundwater, Effluents, Unsaturated soil zone, Subsoil water, Uttar Pradesh(India), Percolating water, Thin molasses, Bacteria, Flow.

The pollution of surface and groundwater due to rapid industrialization in the central and western parts of the providence of Uttar Pradesh in India is a growing problem. The urban industrial waste is treated partially or fully but rural industries allow the spread of effluents in and around their premises. The problem is most acute in the case of the sugar industry which is concentrated in the rural areas. A brief description is given of the nature of the industrial development and its effluent. The effect of effluents of the sugar industry on the unsaturated zone of soil is investigated. The mechanics of the pollution of the subsoil water is examined. (See also W79-07426) (Bell Graf-Cornell)
W79-07459

THE IMPACT OF URBANIZATION ON STREAM QUALITY,
Maryland Univ., College Park.
R. M. Ragan, A. J. Dietmann, and R. A. Moore.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 324-333, 1977. 8 fig, 4 ref.

Descriptors: *Streams, *Water quality, *Urbanization, *Effects, *Biochemical oxygen demand, *Anacosta River basin, Washington(DC), Evaluation, Runoff, Storm water, Urban development, Land use, Floods, Hydrological cycle, Aesthetics, Fish, Streamflow, Natural basins, Landsat data, Sediment loads, Transport curves, Annual loads.

Evaluated is the impact of urbanization on the stream quality of a 1160 km2 area in the suburbs of Washington, D.C. The emphasis of the study was to examine differences in the characteristics of streams collecting runoff from natural basins and those receiving storm water runoff from urbanized areas within the same region and at the same time. Urban development in the study area is primarily recent and well planned. Data from the Landsat satellite were successfully used to separate urban and rural land-use categories. Except in areas found to have sanitary sewage entering the streams, the water quality in the urbanized areas was good. The magnitude of frequent floods was found to have increased substantially as a result of urbanization. This new hydrological regime has resulted in high sediment loads and has reduced the aesthetic value of many streams because of channel widening and degradation. There has also been a sharp reduction in fish species diversity in the urban areas, probably because of habitat destruction rather than water quality degradation. (See also W79-07426) (Bell Graf-Cornell)
W79-07461

INFLUENCE OF CIVIL ENGINEERING PROJECTS ON WATER QUALITY IN DELTAIC REGIONS,
Institute for Soil Fertility, Groningen (Netherlands).
A. J. de Groot, and W. Salomons.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 351-357, 1977. 3 fig, 1 tab, 8 ref.

Descriptors: *Civil engineering, *Projects, *Effects, *Water quality, *Deltas, *Regions, Rivers, Heavy metals, Water pollution, Estuaries, Lagoons, Harbors, Waste discharge, Suspended matter, Pollutants.

The Dutch coastal region contains the mouths of a number of rivers (Rhine, Meuse, Scheldt) which are polluted to a considerable degree with heavy metals. The pollutants are largely associated with the suspended matter in the water. In the estuaries and lagoons, these solids were formerly diluted with relatively uncontaminated marine material and subsequently mainly transported out to sea. Meanwhile, civil engineering projects have resulted in the enclosure of the river mouths (Delta plan) and a lagoon (former Zuyder Sea), as well as in the construction of large harbors (Rotterdam). The creation of fresh water lakes and deep harbors favors the sedimentation of polluted material and restricts discharge out to sea. Furthermore, the longer residence times of the river water in these reservoirs gives rise to an increase in pH and an enhanced adsorption of dissolved pollutants to the sediments. The above-mentioned processes were studied for many years in the relevant areas. The consequences of the enhanced retention of polluted sediments will be discussed with respect to environmental quality. (See also W79-07426) (Bell Graf-Cornell)
W79-07465

GROUNDWATER CONTAMINATION BY WASTE DEPOSITS AND THE IMPLICATIONS FOR METHODS OF REFUSE DISPOSAL,
Hessisches Landesamt fuer Bodenforschung, Wiesbaden (Germany, F.R.).
A. Gowler, G. Matthess, and W. Schneider.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 365-369, 1977. 8 ref.

Descriptors: *Groundwater, *Water pollution, *Waste deposits, *Waste disposal, Effects, Management, Self-purification, Hydrogeological aspects, Waste sites, Precipitation.

During 1964-1973, the effects of three waste deposits on the chemical, physical, microbial and hygien-

ic properties of shallow groundwater were extensively studied. The three waste sites are situated in areas underlain by porous non-consolidated aquifers. With a groundwater flow velocity of less than 1 m/day, the presence of nearby surface water flows and air permeable strata above the groundwater table, the groundwater regains its normal condition by dilution and self-purification after a few or several hundred metres of flow. The self-purification processes cover geochemical and biogeochemical reactions, precipitation and coprecipitation, mechanical filtration, absorption and ion-exchange, and gas exchange. The evaluation of the results and the comparison with other case studies of polluted plumes supply criteria for the choice of sites and feasible methods for controlled dumping. The most suitable forms of groundwater protection are central sanitary landfills, where waste materials of different origin and composition are deposited principally above the groundwater table. Suitable sites are areas with low precipitation, a large distance between the ground surface and the groundwater table, aquifers of good self-purification capacity, poor groundwater quality and low groundwater flow velocity. Areas with unsuitable ground properties (karstic and fissured aquifers) usually necessitate expensive protective measures. (See also W79-07426) (Bell Graf-Cornell)
W79-07467

THE WATER QUALITY EFFECT OF URBANIZATION AND THE RE-USE OF WASTE WATER IN THE PHOENIX, ARIZONA (USA) URBAN AREA,
Boyle Engineering Corp., Phoenix, AZ.
R. L. Ewing.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of Amsterdam Symposium, October, 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 457-466, 1977. 2 fig, 1 tab, 8 ref.

Descriptors: *Water policy, *Urbanization, *Water quality, *Effects, *Water reuse, *Waste water(Pollution), Industrialization, Groundwater, Population growth, Nonpoint source pollution, Phoenix(Arizona).

Water has probably been the single most important factor contributing to the phenomenal growth of the Phoenix urban area (5950 km2 - 1,200,000 population) in the midst of the arid Arizona deserts. However, this tremendous population growth, accompanying domestic requirements and continued agricultural demand have resulted in a groundwater depletion rate of close to 780 x 10 to the sixth power cu m year with an accompanying deterioration of an already poor quality water. Agricultural applications of fertilizers and leaching operations coupled with urban storm water runoff have further aggravated the problem by providing a poorer quality recharge water. To help alleviate this problem, a comprehensive water and water-related land resources management program has been initiated to insure the availability of acceptable quality water for the future. This program includes the evaluation of both point and non-point sources of pollution in the urban area and in addition it addresses the reuse of reclaimed waste water for the enhancement of local water conditions by the use of land application systems and industrial reuse. This includes the use of 173 x 10 to the sixth power cu m/year for atomic plant cooling. (See also W79-07426) (Bell Graf-Cornell)
W79-07476

POLLUTION OF RIVER WATER IN IRAQ,
Ministry of Planning, Baghdad, Iraq.
M. H. Al-Muhandis.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 467-470, 1977.

Descriptors: *Urbanization, *Effects, *Water pollution, *Tigris River(Baghdad), *Iraq, Drainage, Farms, Sewerage, Networks, Pipes, Storm drainage, Agriculture, Industries, Housing.

One of the major problems resulting from undertaking an intensive housing program and establishing farm drainage schemes in Iraq is water pollution of the two main rivers, the Tigris and the Euphrates. The pollution has taken place for the following reasons: (1) there is a large number of pumping stations along the Tigris near Baghdad discharging drainage water from the agricultural areas directly into the river; (2) there is a number of sewage pipes connected to the storm drainage network discharging directly into the main river; (3) there are some natural old drains crossing heavily populated areas, carrying all kinds of effluent directly into the main rivers; and (4) there is a number of private agencies for the removal of sewage from houses by tankers, and these unload into the main river. Important points are given for consideration in the preparation of a plan for a sewerage network system. (See also W79-07426) (Bell Graf-Cornell)
W79-07477

5D. Waste Treatment Processes

THE REGENERATION OF CLINOPTILOLITE BY BIOLOGICALLY RESTORED BRINE,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
M. J. Semmens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 507, Price codes: A10 in paper copy, A01 in microfiche. University of Illinois at Urbana-Champaign, Water Resources Center Final Report No. UIUC-WRC-79-0139, and Research Report No. 139, March 1979. 215 p, 72 fig, 34 tab, 48 ref, 3 append. OWRT B-102-Ill(5).

Descriptors: *Waste water treatment, *Water treatment, *Zeolites, *Ion exchange, *Nitrification, Chemical reactions, Ammonia, Computer models, Biological treatment, Brines, Research and development.

In sequential regeneration of clintoptilolite the ion exchange and nitrification steps are completely separated for the optimization of each process. Neutral pH regeneration studies, initially conducted with brine concentrations compatible with the nitrification process, were extended with computer modeling studies. The simulation models were designed to predict regeneration efficiency and ammonium removal performance during service operations, and were developed to be used as a design tool and to predict zeolite performance under varying operational conditions. In sequential regeneration pilot studies the ion exchange and nitrification processes were operated simultaneously to identify potential operational difficulties, to evaluate ammonium removal performance over numerous operating cycles, to evaluate the chemical requirements and the best regenerant pH, and to determine calcium and magnesium buildup in the recycled regenerant. The kinetics of ammonium oxidation, identified in nitrification studies conducted with recycled regenerant, were comparable to those reported by others for domestic waste water treatment. The rate and extent of ammonium displacement by pH regenerant was observed to be independent of regenerant flow rate in the range of 4 to 20 bed volumes/hr. It is concluded that 75% regeneration of exhausted clinoptilolite may be achieved with 12 bed volumes of 0.3 M sodium chloride. (Davison-IPA)
W79-07002

STUDIES ON THE BIOLOGICAL REGENERATION OF ACTIVATED CARBON,
Rhode Island Univ., Kingston.
G. Houston.
paper copy, A01 in microfiche. Master's Thesis, 1978. 46 p, 4 fig, 7 tab, 33 ref. OWRT A-063-RI(2).

Descriptors: *Activated carbon, *Adsorption, *Microorganisms, E. coli, P. aeruginosa, Growth rates, Organic compounds, Biochemistry, Microbiology, Waste treatment, Waste water treatment, Laboratory tests.

Research is reported on the regeneration of activated carbon exhausted by microorganisms. A mineral medium capable of supporting microbial growth was added to carbon saturated with glucose or hydrocarbon (nonane or decane), and innoculated with Escherichia coli or Pseudomonas aeruginosa. The carbon absorbed the glucose from the solution until an equilibrium was reached between the glucose in solution and that absorbed to carbon. In the glucose-E. coli system carbon regeneration was faster and growth was heavier than in the hydrocarbon-P. aeruginosa system. Glucose supported E. coli growth five days; hydrocarbon supported P. aeruginosa growth for three weeks. The absorption capacity of regenerated carbon previously exhausted with glucose was comparable to that of virgin carbon; the absorption capacity of carbon previously exhausted with the alkanes was reduced about 66%. A surfactant reportedly produced by P. aeruginosa to aid in hydrocarbon solubilization may utilize adsorption sites. The reduced adsorption capacity may also be due to metabolic end products and/or cells of the regenerating organism. The adsorbed hydrocarbon, being more firmly bound, may account for slower regeneration and growth of the organism in closer contact with the carbon. In the glucose-E. coli system, growth characteristics and the fully regenerated adsorption capacity suggest that as glucose is utilized, the less firmly bound nutrient is made available for growth in the liquid medium. (Davison-IPA)
W79-07005

EVALUATION OF LAND APPLICATION SYSTEMS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5E.
W79-07028

REPORT OF WASTE SOURCE INVENTORY AND EVALUATION, DADE COUNTY, FLORIDA, TECHNICAL APPENDIX II, MINOR MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Environmental Research Lab., Athens, GA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 152, Price codes: A16 in paper copy, A01 in microfiche. Report 1971. 354 p, 46 fig.

Descriptors: *Treatment facilities, *Florida, *Domestic wastes, *Performance, *Laboratory tests, *On-site investigations, Waste water treatment, Municipal wastes, Evaluation.

Field and laboratory data and engineering evaluation reports are presented for each of the Dade County, Florida minor domestic waste water treatment plants investigated between December 1970 through February 1971. Original work sheets and data forms are included. Compilation in technical appendix form is for the convenience of pollution control agencies. (Small-FRC)
W79-07029

OPERATIONAL CONTROL PROCEDURES FOR THE ACTIVATED SLUDGE PROCESS - APPENDIX,
National Field Investigations Center-Cincinnati, OH.
A. W. West.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 800, Price codes: A09 in paper copy, A01 in microfiche. Report 1974. 28 p, 9 fig, 4 tab.

Descriptors: *Activated sludge, *Treatment facilities, *Operations, *Municipal wastes, Tests, Maintenance, Monitoring, Sampling.

This is the appendix to a five part series describing operational control procedures for the activated sludge process. The series includes: observations, control tests, calculation procedures, sludge qual-

ity, and process control. The appendix is a reference for lectures on activated sludge plant control. It includes control test data, trend charts, moving averages, semi-logarithmic plots, probability plot examples, testing equipment, and symbols and terminology. (Small-FRC)
W79-07030

TREATABILITY OF OIL AND GREASE DISCHARGED TO PUBLICLY OWNED TREATMENT WORKS,
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 684, Price codes: A02 in paper copy, A01 in microfiche. Report EPA/440/1/75/066, 1975. 16 p, 12 ref.

Descriptors: *Industrial wastes, *Oil industry, *Oil wastes, *Mineral industry, *Waste water treatment, *Performance, *Treatment facilities, Regulation, Biodegradation, Microorganisms.

Available information indicates that grease and oil of animal and vegetable origin is metabolized by microorganisms in secondary waste treatment facilities. Thus, pretreatment requirements are not needed for these compounds. Oils and grease of mineral or petroleum origin are less biodegradable. One study indicated that the influent to biological treatment systems should contain less than 75 mg/liter and preferably less than 50 mg/liter oil and grease. Because a dilution of at least two occurs, a limit of 100 mg/liter on the discharge of oils and grease of petroleum and mineral origin is reasonable. (Small-FRC)
W79-07032

NEED FOR IMPROVED OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS. (REPORT TO CONGRESS),
Comptroller General of the United States, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 296, Price codes: A06 in paper copy, A01 in microfiche. Report B-166506-700901, 1970. 104 p, 1 fig, 1 tab, 11 append.

Descriptors: *Treatment facilities, *Performance, *Municipal wastes, *Industrial wastes, *Inspection, *Operations, Maintenance, Toxicity, Biological treatment, Biodegradation, Evaluation.

Federal Water Quality Administration studies and records of plant inspections were reviewed and waste treatment plants were inspected in this investigation of operation and maintenance problems. Many plants were experiencing problems due to inadequate controls over industrial sources of pollution, inadequate numbers of qualified personnel, and inadequate plant design or equipment deficiencies. Municipal plants experience difficulty treating industrial wastes that have not been pretreated. In some cases, toxic industrial wastes can kill bacteria necessary for secondary treatment. Design deficiences result in insufficient plant capacity or insufficient equipment. Difficulties with equipment is a major problem. Suggestions of the prevention, detection, and correction of municipal plant operation and maintenance problems are presented. The Federal Water Quality Administration should establish comprehensive guidelines for determining operation and maintenance needs and help the state improve procedures for preventing, detecting, and correcting plant problems. (Small-FRC)
W79-07033

ENVIRONMENTAL EFFECTS OF LAND APPLICATION OF DIGESTED MUNICIPAL SEWAGE SLUDGE,
National Science Foundation, Washington, DC. Applied Science and Research Applications.
J. T. Trout, J. L. Smith, and D. B. McWhorter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 481, Price codes: A07 in paper copy, A01 in microfiche. Report NSF-RA-E-75-186, 1975. 137 p, 16 fig, 22 tab, 75 ref, 7 append.

Descriptors: *Land management, *Application methods, *Municipal wastes, *Sewage sludge, *Environmental effects, Coliforms, Biochemical oxygen demand, Groundwater, Water pollution, Leachate, Nutrients, Heavy metals, Monitoring.

The land application of municipal sewage sludge was investigated as an alternative to other disposal methods and as a method to reuse beneficial sludge constituents. A subsurface injector was used to apply sludge from a 4.3 mgd waste water treatment plant in Boulder. Colorado to a 4.4 hectare site. Potential environmental hazards included pathogen, heavy metal, nutrient, and salt contaminants to soil and groundwater. Monitoring was carried out using groundwater monitoring wells and leachate vacuum extractors. Also, corn was grown on one sludge treated area. Leachate, groundwater, soil, and corn tissue were analyzed. Salt buildup can create a short term hazard. Ninety-nine percent of the sludge BOD loading was retained in the soil, and oxygen demand presented no hazard to the groundwater. Fecal coliforms did not extend more than 120 to 150 cm into the soil, and did not last more than 2 1/2 months on the soil surface. Heavy metal contaminated was not a problem up to 65 m ton/ha sludge loadings. Nitrate leaching to the groundwater was substantial, but can be controlled with management techniques involving balancing nitrogen applications with crop uptake. Monitoring is necessary for sludge application programs to detect any environmental hazards. (Small-FRC)
W79-07036

EVALUATION OF PHYSICAL CHEMICAL TREATMENT AT ROSEMOUNT,
Metropolitan Waste Control Commission, St. Paul, MN.
R. C. Polta, R. W. DeFore, and W. K. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 288, Price codes: A06 in paper copy, A01 in mirofiche. Report EPA-600/2-78-201, 1978. 188 p, 48 fig, 64 tab, 39 ref.

Descriptors: *Treatment facilities, *Tertiary treatment, *Monitoring, *Filtration, *Carbon filters, Ion exchange, Lime, Biochemical oxygen demand, Suspended solids, Phosphorus, Ammonia, Waste water treatment, Municipal wastes.

A performance and cost evaluation was conducted over a two-year period at the 0.25 mgd demonstration Rosemount, Minnesota, advanced waste water treatment plant. The facility utilizes chemical clarification, filtration, carbon adsorption, and ion exchange, with carbon regeneration and zeolite regeneration and brine recovery for the ion exchange media conducted on-site. Over the two-year period, the plant averaged removals of 99% suspended solids, 93% BOD, and 94% total phosphorus. The chemical feed systems included lime, ferric chloride, polymer and nitrate, sulfuric acid, chlorine, and caustic. Significant variation in ammonia reduction occurred due to modifications in the zeolite regeneration system. When the lime controlled pH of the waste water was lowered from 10.5 to 9.5 treatment efficiency decreased significantly; ferric chloride dosing maintained an effluent phosphorus level of 1 mg/liter or less. Carbon columns averaged 55% soluble COD reduction; excessive carbon losses were attributed to the lack of adequate screening. Regenerant volume and pH were found to be the most significant variables in the ion exchange system for removing NH3-N. From the demonstration plant data, it was estimated that a 10 mgd tertiary treatment plant would cost $.56-.83/1000 gal for operation and maintenance. (Lisk-FRC)
W79-07037

PERFORMANCE EVALUATION OF THE AERATED LAGOON SYSTEM AT WINDBER, PENNSYLVANIA,
Pittsburgh Univ. at Johnstown, PA. Div. of Natural Sciences.
C. M. Earnest, E. A. Vizzini, D. L. Brown, and J. L. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 368, Price codes: A13 in paper copy, A01 in microfiche. Report EPA-600/2-78-023, 1978. 295 p, 11 fig, 8 tab, 6 ref, 5 append.

Descriptors: *Aerated lagoons, *Sewage treatment, *Water quality standards, *Biochemical oxygen demand, *Nitrification, Suspended solids, Coliforms, Nitrates, Nitrites, Aeration, Waste water treatment, Municipal wastes, Monitoring.

The treatment effectiveness of the Windber, Pennsylvania, 2.0 mgd waste water aeration lagoon was monitored over a one-year period. Effluent from the aerated lagoon system, which consists of three cells in series, consistently met Federal Secondary Treatment Standards for suspended solids, fecal coliforms, pH, and BOD except during the month of July when BOD removal decreased to 82%. The cause of this reduced efficiency was attributed to a solids upset in the first cell. Further study of the occurrance of solids upset in the cells was recommended. Nitrate-nitrogen ion concentrations exceeded nitrite-nitrogen levels during the monitoring period except in June, July, and August when a reversal was observed. The cause of the formation of a less oxidized form of nitrogen in the nitrification process was unknown. The aerated lagoon treatment system was considered a suitable process for small towns with similar climates to the Pennsylvania facility. (Lisk-FRC)
W79-07038

LABORATORY AND PILOT PLANT EVALUATION OF INTERMITTENT LOADING ON SMALL-SCALE EXTENDED AERATION BIOLOGICAL SYSTEMS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
J. L. Mahloch, D. E. Averett, and M. Headstream.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 751, Price codes: A06 in paper copy, A01 in microfiche. Report 1977. 96 p, 23 fig, 27 ref, 3 append.

Descriptors: *Mathematical models, *Activated sludge, *On-site data collections, *Aeration, *Seasonal, Waste water treatment, Performance, Laboratory tests.

A mathematical model was developed to predict the performance of a completely mixed activated sludge system under intermittent loading conditions which are defined as time-dependent hydraulic and organic loading conditions. The model was first verified with laboratory data from a bench scale extended aeration system. It was also verified with field data from a prototype extended aeration package treatment plant. Parameters included effluent quality, dissolved oxygen uptake, and other performance indicators. The laboratory study indicated that an extended aeration activated sludge system will generally perform satisfactorily under intermittent loading conditions. (Small-FRC)
W79-07039

FIELD INVESTIGATION OF SHIPBOARD/SHORESIDE SEWAGE TRANSFER SYSTEMS AT THE SAN DIEGO NAVAL STATION,
Pollution Abatement Associates, Corte Madera, CA.
For primary bibliographic entry see Field 8A.
W79-07040

ECOLOGICAL ASSESSMENTS FOR WASTEWATER MANAGEMENT IN SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5C.
W79-07041

SELF-CONTAINER SANITATION SYSTEMS FOR 2- TO 15-MAN POLAR FACILITIES,
Naval Civil Engineering Lab., Port Hueneme, CA.
B. W. Valentine.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-893 724, Price codes: A03 in paper copy, A01 in microfiche. Report, 1972. 41 p, 5 fig, 17 tab, 19 ref, 5 append.

Descriptors: *Sewage treatment, *Evaluation, *Costs, *Chemical degradation, *Chemicals, Waste storage, Sanitary engineering, Design, Polar regions.

The NCEL Mechanical-Flush Chemical Toilet was compared with commercially available self-contained sanitation systems. The toilet consisted of a simple baffled tank and mechanical flushing system. Copper sulfate pentahydrate and sodium bisulfate are used to treat the waste. The toilet has a 13 gal capacity. Estimated cost to produce large quantities of units is $250 to $300. The toilet has been laboratory and field tested. The Thetford Model 600 minimum-water flush toilet was the most cost effective system for pioneer polar camps housing 2 to 6 men. The Mission West Model 727 recirculating chemical toilet should be considered for camps with more than four men in areas of minimum water supply. Although the NCEL Mechanical-Flush Chemical Toilet possesses many desirable features, no further effort is recommended to develop the system for use in a polar camp. (Small-FRC)
W79-07042

PROCESS DESIGN FOR TREATING SHOWER WASTEWATER BY ULTRAFILTRATION,
Army Mobility Equipment Research and Development Command, Fort Belvoir, VA. Energy and Water Resources Lab.
D. S. Lent.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 716, Price codes: A09 in paper copy, A01 in microfiche. Report, 1977. 172 p, 8 fig, 4 tab, 5 append.

Descriptors: *Mathematical models, *Waste water treatment, *Filtration, *Performance, *Domestic wastes, Boundary layers, Equations, Membranes.

Curve fitting was investigated for the empirical explanation of shower waste water treatment by ultrafiltration. A two-part model is proposed. Initially, the formation of the boundary layer causes an unsteady state. Later, the system comes to a steady state when the rates of boundary layer formation and decay reach constant values. The model was evaluated on two separate ultrafiltration systems. Each system had a different membrane configuration. The hollow-fiber system can be described by a single, empirical equation of exponential order because the system studied was never allowed to reach steady state. The spiral-wound membrane system can be described emperically by an exponential equation during boundary layer formation and by a linear equation during steady state operation. (Small-FRC)
W79-07043

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA EMMA STUDY, VOL. 6. FORMULATION OF WASTEWATER UTILIZATION PLAN,
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 800, Price codes: A04 in paper copy, A01 in microfiche. Report, 1975. 67 p, 8 fig, 12 tab.

Descriptors: *Municipal wastes, *Sewage treatment, *Waste water treatment, *Project planning, *Costs, Massachusetts, Coasts, Ultimate disposal.

Formulation of the waste water utilization plan for EMMA is described. The maximum Deer and Nut Island treatment plant service area was established and peripheral communities were eliminated from further analysis. Various factors important to the selection process were identified and evaluated. A rating form was developed to assist the technical subcommittee in listing the factors to be considered. A concept of moderate decentralization was adopted, and the recommended plan was selected. The recommended plan included the enlargement of the Deer Island Treatment Plant and the reduction of the service area for the Nut Island plant. Fifty-one communities are included. Secondary treatment will be provided at the coastal plants and advanced treatment at inland plants. Construction staging alternatives are discussed. Other treatment options are explored including total ocean discharge and ocean discharge in lieu of secondary treatment. A cost comparison is included of treatment options and the recommended plan. (Small-FRC)
W79-07044

CARBON TREATMENT OF OTTO FUEL WASTEWATER - A LABORATORY STUDY,
Naval Surface Weapons Center, White Oak Lab., Silver Spring, MD.
J. E. Mastroianni, and W. F. Newton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 986, Price codes: A02 in paper copy, A01 in microfiche. Report, 1977. 22 p, 6 fig, 7 tab, 2 ref, 5 append.

Descriptors: *Activated carbon, *Adsorption, *Waste water treatment, *Fuels, *Performance, Costs, Pilot plants, Incineration, Landfill.

Activated carbon was effective in removing Otto Fuel from waste water generated in overhauling and refueling the MK46 and MK48 torpedoes. Otto fuel is composed of a nitrate ester in solution with a desensitizing agent and a stabilizer. A preliminary large-scale run on the Calgon Filterasorb Pilot Plant showed a carbon cost of $.018/gal of waste water treated as compared to .43/gal for disposal by incineration. Filtersorb 400 was selected after a comparison study of eight commercially available carbons. Former waste water treatment methods included incineration and landfill; both are effective but expensive. (Small-FRC)
W79-07045

EVALUATION OF AN EXTENDED AERATION PROCESS FOR SKOKOMISH SALMON PROCESSING WASTEWATER TREATMENT,
Kramer, Chin, and Mayo, Inc., Seattle, WA.
S. S. Lin, and P. B. Liao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 750, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-79-027, 1979. 128 p, 18 fig, 13 tab, 10 ref, 3 append.

Descriptors: *Food processing industry, *Industrial wastes, *Waste water treatment, *Aeration, *Performance, Biochemical oxygen demand, Suspended solids, Ammonia, Nitrogen, Phosphorus, Pilot plants, Chemical oxygen demand, Oil.

Waste water characteristics for hand-butchered salmon processing determined that small salmon processing generated more waste water flow and higher pollutant contents per kkg of fish processed than did large salmon processing. For both cases, waste water flows and pollutant concentrations were highly variable. For full-scale plant operation, removal efficiencies of BOD, COD, suspended solids, grease and oil, and ammonia for small fish processing were similar to those for large fish processing. Higher removal efficiencies for nitrogen and lower removal efficiencies for phosphorus during large fish processing were the result of low flow resulting in longer detention times and overaeration. The effect of shorter detention times was investigated in a pilot plant study. Pilot plant removal efficiencies were similar to those for the full-scale plant for COD, BOD, TKN, and ammonia, but higher for solids, grease and oil, and phosphorus. The shorter detention time and proper overflow rate resulted in higher removal efficiencies for suspended solids, oil and grease, and phosphate. During long periods of processing plant shutdown, artificial feeding with fish food and no feeding were studied. At startup, the system was able to handle normal loading in both cases. (Small-FRC)
W79-07046

AN ECONOMIC COMPARISON OF SLUDGE IRRADIATION AND ALTERNATIVE METHODS OF MUNICIPAL SLUDGE TREATMENT,
Battelle Pacific Northwest Lab., Richland, WA.
S. B. Ahlstrom, and H. E. McGuire.
Available from the National Technical Information Service, Springfield, VA 22161 as PNL-2431, Price codes: A08 in paper copy, A01 in microfiche. Report PNL-2431, 1977. 151 p, 9 fig, 14 tab, 30 ref, 2 append.

Descriptors: *Irradiation, *Sludge treatment, *Disinfection, *Costs, *Performance, Heavy metals, Microorganisms, Municipal wastes, Biodegradation.

The relative economics of radiation treatment of sludge and other treatment processes is discussed. Radiation is a high-level disinfection process and should be considered only if high levels of disinfection are required. The handling, transporting, and pathogen growback problems associated with disinfected wet sludge, make it less attractive for reuse than dry sludge. The radiation of composted sludge produces a product of similar quality at less cost than any thermal treatment and/or flash drying treatment with high degrees of disinfection. When pathogens are inactivated, the sludge can be reused as, for example, a soil conditioner. Heavy metal content, especially cadmium, may limit the reuse of sludge despite high disinfection levels. Sludge subjected to treatment schemes producing only 5% moisture has probably been disinfected sufficiently without being irradiated. The cost of irradiating wet sludge is greater than the cost of pasturization; thus, irradiation is not a desirable method for wet sludge. Radiation is the least expensive option for dry sludge if additional disinfection is required after composting. (Small-FRC)
W79-07047

TOTAL RECYCLE SYSTEMS FOR PETROCHEMICAL WASTE BRINES CONTAINING REFRACTORY CONTAMINANTS,
Dow Chemical Co., Freeport, TX.
M. A. Zeitoun, C. A. Roorda, and G. R. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 158, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-79-021, 1979. 108 p, 37 fig, 23 tab, 15 ref, 5 append.

Descriptors: *Industrial wastes, *Waste water treatment, *Recycling, *Reverse osmosis, *Electrodialysis, Salts, Chemical wastes, Ammonia, Organic compounds, Costs, Adsorption.

The feasibility of total recycle of petrochemical waste waters was studied. A combination of reverse osmosis and electrodialysis was operated as a hybrid system using pretreated wastes. The waste water is generally high in salt and refractory organics. Stream 1 had a salinity of 1.4% NaCl when neutralized and contained on the average 0.5% organic amines and ammonia. It contained enough silica to foul the membranes. Stream 2 contained 4.5% dissolved solids and precipitated aluminum salts when neutralized with acid. The average organic content of aromatics was 90 mg/liter of TOC. The total recycle system for Stream 1 was composed of ammonia stripping, carbon adsorption and recovery of organic amines, neutralization, and silica removal before the ED-RO hybrid. The total recycle system for Stream 2 was composed of neutralization, settling and centrifugation to recover Al(OH)3, and carbon adsorption with thermal regeneration before the ED-RO hybrids. For a 1 mgd treatment facility, Stream 1 capital cost is estimated at $6,949,550 (1975 dollars), and Stream 2 is $9,170,000. Operating cost for Stream 1 is $5,291,700, and $2,293,700 for Stream 2. For Stream 1, the carbon adsorption step has estimated operating cost of $2,358,000 and the recovered organics should recycle at an estimated $3,000,000. The system was not economically feasible when applied to industrial waste waters containing relatively high concentrations of salt. (Small-FRC)
W79-07048

DRAFT ENVIRONMENTAL IMPACT STATEMENT: GREENSBORO-GUILFORD COUNTY, NORTH CAROLINA, 201 WASTEWATER TREATMENT SYSTEM, EPA PROJECT NOS. C37037601, C37036901.
Environmental Protection Agency, Atlanta, GA. Region IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 097, Price codes: A15 in paper copy, A01 in microfiche. Report, 1977. 323 p, 162 fig, 60 tab, 87 ref.

Descriptors: *Environmental effects, *Treatment facilities, *Outlets, *Outfall sewers, *North Carolina, Tertiary treatment, Streams, Odor, Evaluation, Flood control, Silting, Air pollution, Waste water treatment, Municipal wastes, Water pollution.

An environmental impact statement has been completed for Greensboro-Guilford County, North Carolina, where the existing North Buffalo Creek Treatment plant will be upgraded to tertiary treatment at 16 mgd, abandoning the South Buffalo Creek Treatment Plant, and constructing a 60-in. diameter outfall from that plant location to a new 20 mgd plant located 26,000 ft downstream on South Buffalo Creek. These actions will eliminate the discharge of inadequately treated municipal waste water, provide adequate facilities for the treatment of existing and future waste loads, and allow for orderly growth in the county. The major direct adverse impacts will be temporary increases in stream siltation and air-borne particulates; some natural vegetation destruction; elevated noise levels; stressed stream quality in the Greensboro vicinity due to industrial discharges and urban runoff; a substantial decrease in streamflow below the existing facility; and the need for control of disease carrying or transmitting insects below the existing outfall for several years. Adverse secondary impacts will be increased flooding, increased urban runoff, continued terrestrial habitat attrition, and increased air pollution due to population growth. In addition to improved water quality, beneficial impacts will be odor abatement near the old plant, and orderly planning of urban growth without detrimental environmental impacts. (Lisk-FRC)
W79-07053

POLLUTION FROM MAJOR MUNICIPAL WASTE SOURCES IN DADE COUNTY, FLORIDA,
National Field Investigations Center, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 327, Price codes: A03 in paper copy, A01 in microfiche. Report EPA/330/2-71/002, 1971. 36 p, 1 fig, 8 tab, 1 append.

Descriptors: *Treatment facilities, *Biochemical oxygen demand, *Suspended solids, *Discharge measurement, Effluents, *Activated sludge, Tertiary treatment, Waste water disposal, Streams, Channels, Waste water treatment, Florida, Municipal wastes.

An inventory of the major sources of municipal wastes in Dade County, Florida, the treatment efficiencies of 27 municipal waste water plants, and the impacts of wastes on receiving waters are presented. Of the 27 plants surveyed, 16 utilize the activated sludge process, five plants have trickling filters, the remainder have a combination of these two treatment processes, 3 plants provide additional treatment with microstrainers, 2 plants provide tertiary treatment, and 3 plants have oxidation lagoons. About 41% of the plants reduce BOD by 90% or more, 11 plants provide 80-90% removal, and 19% remove less than 80% of the BOD. About 22% of the plants achieve 90% or more suspended solids removal, 11 plants remove 80-90% of suspended solids, and 36% provide less than 80% removal. Five plants achieve 90% BOD and suspended solids removal; these plants discharge about 2% of the total municipal waste water, indicating that the remaining 98% of the municipal waste water receives inadequate or no treatment. The daily BOD and suspended solids loadings on waterways and tributaries from municipal waste water treatment facilities are discussed. (Lisk-FRC)
W79-07054

SEPTIC TANK - SAND FILTER SYSTEMS FOR TREATMENT OF DOMESTIC SEWAGE,
Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
N. A. Chowdhry.
Report W64, 1977. 47 p, 10 fig, 21 tab.

Descriptors: *Filtration, *Domestic wastes, *Sewage treatment, *Sands, *Soil filters, *Performance, Phosphorus, Nitrogen, Efficiencies, Biochemical oxygen demand.

In a continuation of a study of domestic sewage treatment by underdrained filter systems, four filters containing media with different chemical and/or physical characteristics were investigated for capability of phosphorus removal. The media were sand, red mud, crushed limestone, and natural soil. Biochemical oxygen demand was reduced by 96% or more and nitrogen compounds were oxidized to nitrates leaving only traces of ammonia and organic nitrogen. Red mud was the most effective in the removal of phosphorus. There was an efficiency of more than 89% during the first year and was 62% after five years of operation. Crushed limestone had an initial efficiency of 89% for phosphorus removal, but this declined rapidly after 3 months. Natural soil filters reduced phosphorus content by 68% during the first year and by 48.4% by the end of the second year. Soil filter efficiency depended on the silt and clay content of the soil. (Small-FRC)
W79-07055

OPERATIONAL CONTROL PROCEDURES FOR THE ACTIVATED SLUDGE PROCESS. PART III-B. CALCULATION PROCEDURES FOR STEP-FEED PROCESS RESPONSES,
National Field Investigations Center-Cincinnati, OH.
A. W. West.
Report, 1975. 31 p, 7 fig, 2 tab.

Descriptors: *Activated sludge, *Operations, *Equations, *Flow, *Design, Aeration, Waste water treatment, Sewage treatment, Performance, Oxidation.

Calculation procedures used to determine the sludge and waste detention times in a step-feed configuration are described. The aeration tank characteristics used in a presented example differ from those in Part III-A because the tank is divided onto four equal step-feed bays. Flows differ only slightly when the sludge wasting rate is set at zero. Shifting waste water in-flow locations exerts forces on mixed liquor sludge oxidation that are opposite to those exerted on waste water treatment. The illustrated examples are intended to emphasize how the activated sludge process reacts to changes in waste water feed-point locations. Calculation Forms are presented which illustrate an orderly procedure to determine, and at times predict, process response to various step-feed loadings. (Small-FRC)
W79-07058

OPERATION OF STABILIZATION PONDS IN A TROPICAL AREA,
Gorgas Memorial Inst., Washington, DC.
L. E. Eckley, L. Cantor, and G. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-B015 604, Price codes: A13 in paper copy, A01 in microfiche. Report, 1974. 294 p, 3 fig, 67 tab, 88 ref, 11 append.

Descriptors: *Oxidation lagoons, *Anaerobic digestion, *Aerobic treatment, *Sewage treatment, Biodegradation, *Tropical regions, Biochemical oxygen demand, Chemical oxygen demand, E coli, Nutrient removal, Waste water treatment, Municipal wastes.

A series of phase studies investigated the use of single and multiple stabilization ponds for the treatment of secondary waste waters as a simple and inexpensive method of treatment in tropical regions. Initial studies established single ponds 4-6 ft in depth; subsequent studies evaluated multiple pond configurations providing anaerobic and aerobic modes of operation. The optimum pond configuration for treating the waste waters was found to be a three pond system, operating in the order of an anaerobic pond, a facultative pond, and a maturation pond. This system reduced BOD by 75%, COD by 60%, organic and ammonia nitrogen by 58%, and E. coli by 91%; orthophosphates and nitrates increased in this and most other systems studied. The maximum loading for this system was 150 lb BOD/acre/day. Design effluent removals based on influent content, influent-effluent flow, and meteorological considerations were developed with multiple regression analyses. Studies were also conducted on S. typhi survival in the ponds, shock loadings of selected pesticides, mosquito control, and sludge build-up. (Lisk-FRC)
W79-07059

TREATMENT OF AMMONIA PLANT PROCESS CONDENSATE EFFLUENT,
Louisiana Chemical Association, Baton Rouge.
C. J. Romero, F. Yocum, J. H. Mayes, and D. A. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 069, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-200, 1977. 84 p, 24 fig, 30 tab, 13 ref.

Descriptors: *Ammonia, *Metals, *Water pollution sources, *Distillation, Pilot plants, Carbon dioxide, Recycling, *Industrial wastes, Waste water treatment, Standards.

Seven ammonia plants were investigated for process condensate contaminant content and selected treatment techniques. Samples from each stream were analyzed for ammonia, methanol, and carbon dioxide. Metal analysis was performed for copper, nickel, iron, zinc, and chromium concentrations. Average values for contaminants were: ammonia, 873 mg/liter; methanol, 524 mg/liter, and carbon dioxide, 1809 mg/liter. Steam stripping was evaluated for the removal of ammonia from process condensate. Steam stripping bench tests and plant evaluations indicated that the method was a viable process for the reduction of ammonia and methanol in ammonia process condensate streams and will achieve EPA established guidelines. In the commercial unit evaluated, it was possible to strip the condensate and recycle the bottoms to the boiler feedwater system. The bottoms could be used for cooling towers make-up without further treatment. Trace metal levels in the condensate did not present a problem in the recycle of bottoms. Stripping the process condensate and injecting the vapor into the reformer stack was a successful control technology for reducing the amount of ammonia and methanol discharged to the environment. (Small-FRC)
W79-07060

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
J. G. Kutcher, and R. P. Kramer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 995, Price codes: A99 in paper copy, A01 in microfiche. Report EPA-600/9-77-037, 1977. 718 p.

Descriptors: *Waste water treatment, *Municipal wastes, *Abstracts, Water quality, *Water pollution, *Sewage treatment, Treatment facilities, Analytical techniques, Hydrology, Model studies, Sewers, Waste disposal, Indexing, Documentation, Cities.

This current awareness abstracting bulletin contains 1320 abstracts on methods of municipal waste water treatment, water quality problems, and water pollution control. The abstracted literature appeared in print during 1976-1977 and included the topics of: storm runoff, sewer systems, patents,

treatment methods, analytical techniques, model studies, hydrologic aspects, and miscellaneous data relating to water quality and pollution control. Also included is information on analytical techniques for water quality measurement; biological, chemical, and physical methods of waste water treatment, disposal, and recycling; construction and equipment for pollution control; mathematical, statistical, and simulation model studies; storm runoff; tunnelling technology and sewer systems; and treatment plant operation and automation. The report also includes a journal list, and subject and author indices. (Lisk-FRC)
W79-07061

PHOSPHORUS REMOVAL FROM HUMAN WASTEWATER BY DIRECT DOSING OF ALUM TO A SEPTIC TANK,
Ontario Ministry of the Environmental, Toronto. Applied Sciences Section.
M. Brandes.
Report of the Ministry of the Environment-Ontario, 1976. 49 p, 6 fig, 9 tab, 35 ref, 1 append.

Descriptors: *Septic tanks, *Domestic wastes, *Chemical precipitation, *Phosphorus, *Sludge, Nutrient removal, Chemical reactions, Waste water treatment.

Automatic dosing of alum to a two compartment septic tank was evaluated as a means of precipitating phosphorus. The system was designed to add alum in a measured dose to the septic system with each toilet flush; the septic tank received only toilet wastes. The phosphorus concentration in the tank before dosing was 19.6 + or - 0.5 mg/liter as P. Alum was added to the tank at an alum to phosphorus ratio of about 2. At this rate, the phosphorus concentration was reduced by 96.3% to about 0.72 mg/liter. Dissolved phosphorus levels decreased to 0.13 mg/liter. Although sulfates in the effluent increased with alum treatment, concentrations were below those acceptable for drinking water. Precipitation in the tank caused by alum dosing increased the rate of sludge accumulation from 62.0 liters/person/year to 146.0 liters/person/year. However, the time period in which sludge would reach permissable levels in the tank would not be less than 4.4 years. The alum dosing system was considered simple and cost effective in areas with high water tables or in systems located on bedrock or near to receiving waters. (Lisk-FRC)
W79-07062

OVERLAND FLOW IN THE LOUISIANA COASTAL ZONE; THE POTENTIAL FOR LAND TREATMENT OF WASTE WATER ON DIKED DREDGED SPOIL DISPOSAL SITES IN SOUTH LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
M. Meo, J. W. Day, and T. B. Ford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 327, Price codes: A04 in paper copy, A01 in microfiche. Report, 1975. 59 p, 7 fig, 16 tab, 36 ref.

Descriptors: *Waste water treatment, *Land use, *Application methods, *Pilot plants, *Organic matter, Louisiana, Municipal wastes, Industrial wastes, Carbon, Phosphorus, Nitrogen, Performance, *Overland flow.

Land treatment of organic waste water through overland flow is discussed as an effective and economical means of dealing with increased waste loads while achieving federally mandated water quality criteria. A pilot plant project in an enclosed marsh area in Dulac, LA, using effluent from a menhaden processing plant found overland flow to be an effective secondary treatment method, and in some cases, an effective tertiary treatment method. Primary treated organic waste was sprayed at a low rate on a naturally vegetated slope. The soil-plant system removed 85% of total organic carbon, 53% total phosphorus, and 51% total nitrogen. Overland flow is well suited to coastal Louisiana needs because of the soil type, high water table, long growing season, and the nature of organic wastes (fish processing and canning wastes, sugarcane processing wastes, and municipal sewage wastes). There are many possible agricultural and aquaculture applications in the region. (Small-FRC)
W79-07065

DRAFT ENVIRONMENTAL IMPACT STATEMENT, CITY OF JACKSONVILLE, FLORIDA, WASTEWATER MANAGEMENT FACILITIES, ARLINGTON-EAST SERVICE DISTRICT.
Environmental Protection Agency, Atlanta, GA. Region IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 591, Price codes: A21 in paper copy, A01 in microfiche. Report EPA 904/9-75-006, 1975. 433 p, 67 fig, 60 tab, 75 ref, 11 append.

Descriptors: *Environmental effects, *Municipal wastes, *Treatment facilities, *Construction, *Highway effects, Waste water treatment, Activated sludge, Odor.

The proposed sewage treatment facilities for Arlington-East are described and their environmental impact is evaluated. The proposed plant will have an initial capacity of 10 mgd and an ultimate capacity of 25 mgd. The waste water will be treated by screening, preaeration, grit removal, primary settling, activated sludge aeration, secondary settling, sludge return facilities, and effluent chlorination. Treated plant effluent will be discharged into the St. Johns River. Construction impacts include loss of wildlife habitat, short-term impacts such as dust, noise, traffic, and soil erosion, and short-term disruption of two acres of salt marsh. Operational impacts include discharge of treated waste water into the river, and operational noise and odor. Secondary impacts include the potential for development of areas set aside for preservation and conservation with associated potential needs for water supply, transportation, recreation areas, and other community facilities. (Small-FRC)
W79-07066

COST AND EFFECTIVENESS COMPARISONS OF VARIOUS TYPES OF SLUDGE IRRADIATION AND SLUDGE PASTEURIZATION TREATMENTS,
Sandia Labs., Albuquerque, NM.
For primary bibliographic entry see Field 5E.
W79-07067

PERFORMANCE EVALUATION OF KILMICHAEL LAGOON,
Mississippi State Univ., Mississippi State. Coll. of Engineering.
D. O. Hill, and A. Shindala.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 927, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/2-77-109, 1977. 220 p, 23 fig, 12 tab, 3 append.

Descriptors: *Municipal wastes, *Sewage lagoon, *Performance, *Suspended solids, *Biochemical oxygen demand, Seasonal, Algae, Standards, Design, Coliforms, Disinfection.

A three-cell facultative lagoon at Kilmichael, Mississippi was evaluated from the point of view of design criteria and secondary treatment standards for municipal facilities. Performance varied by day and by season; thus, the facility did not consistently meet standards. Total BOD was generally less than 30 mg/liter. Soluble BOD was consistently less than 10 mg/liter. Suspended solids were consistently outside secondary limits and contributed the major portion of the total BOD. Also, suspended solids were responsible for the daily and seasonal variations. An effective algae removal technique could result in excellent, consistent lagoon performance. Fecal coliform determinations were consistently higher than an MPN of 200/100 ml. An appropriate disinfection system is needed to protect the receiving water. (Small-FRC)
W79-07068

PERFORMANCE EVALUATION OF AN EXISTING LAGOON SYSTEM AT EUDORA, KANSAS,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
R. E. McKinney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 653, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/2-77-167, 1977. 231 p, 1 fig, 42 tab, 3 ref, 1 append.

Descriptors: *Suspended solids, *Municipal wastes, *Sewage lagoons, *Performance, *Algae, Standards, Nutrients, Nitrogen, Phosphorus, Coliforms.

The performance of waste water lagoons at Eudora, Kansas, were evaluated for one year. The lagoons consisted of three cells placed in series. Raw waste water characteristics were normal for a small residential community, and the lagoons produced typical results. The lagoons could not meet EPA effluent criteria for secondary treatment because of excessive suspended solids in the final effluent. The high suspended solids were primarily due to living and dead algae. Most of the waste organic stabilization took place in Cell 1 with algae recycling nutrients in Cell 2 and Cell 3. Recycling of nutrients by algae results in a slow but steady reduction of nitrogen and phosphorus in the lagoons. Temperature had the greatest influence on the growth and predomination of various species of bacteria and the die-off of fecal coliform bacteria. Removal of the suspended solids would result in meeting EPA effluent criteria. (Small-FRC)
W79-07069

INVESTIGATION INTO THE APPLICATION OF PHYSICO-CHEMICAL PROCESSES FOR MUNICIPAL WASTE-WATER TREATMENT (ONDERZOEK NAAR DE TOEPASSINGSMOGELIJKHEDEN VAN FYSISCH-CHEMISCHE PROCESSEN VOOR DE ZUIVERING VAN HUISHOUDELIJK AFVALWATER),
F. Bloot, C. J. Duyverman, B. A. Heide, P. J. F. van der Most, and A. van Vliet.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-24013, Price codes: A05 in paper copy, A01 in microfiche. Report, 1975. 92 p, 15 fig, 16 tab, 45 ref, 1 append.

Descriptors: *Flocculation, *Coagulation, *Chemical precipitation, *Nutrient removal, *Activated carbon, Biological treatment, Adsorption, Aeration, Calcium hydroxide, Chemical oxygen demand, Disinfection, Reverse osmosis, Capital costs, Waste water treatment, Municipal wastes.

Physico-chemical treatment of municipal waste water was evaluated as an alternative to biological treatment. The sequence of physico-chemical treatment of waste water comprises the process stages: mechanical pretreatment for the removal of solids and sand; coagulation/flocculation to remove colloidal particles or to remove phosphates with calcium hydroxide; aeration through an alkaline liquid to remove ammonia; recarbonation to convert calcium hydroxide to calcium carbonate followed by carbonate removal by adjusting the pH to 7; activated carbon adsorption of COD, and regeneration of the carbon. The waste water may be rendered potable by further disinfection and demineralization by reverse osmosis. Pilot plant studies of physico-chemical treatment have indicated that effluent quality expressed in terms of COD and Kjeldahl-nitrogen was not significantly different than effluent from biological treatment. At effluent outputs of about 20,000 cu m/day, physico-chemical treatment capital costs were lower than a comparable biological treatment system; variable costs, such as energy requirements, are higher for physicochemical treatment. This treatment was considered more suitable for treating waste waters which are toxic to biological systems. Physico-chemical treatment may be used in conjunction with biological treatment for removal of COD, metals, and salts; where waste water is to be reused as industrial or drinking water; or when biological systems are overloaded. (Lisk-FRC)

W79-07071

NITRATE REMOVAL IN CLOSED-SYSTEM AQUACULTURE BY COLUMNAR DENITRIFICATION,
Rhode Island Univ., Kingston. Dept. of Microbiology.
W. L. Balderston, and J. Sieburth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 166, Price codes: A02 in paper copy, A01 in microfiche. Report NOAA-77041526, 1976. 5 p, 3 fig.

Descriptors: *Denitrification, *Salmonids, *Monitoring, *Waste water treatment, *Agriculture, Ammonia, Sulfides, Carbon, Nitrite, Aquatic bacteria.

The columnar denitrification of nitrate-nitrogen removal from high-density, closed system, salmonid aquaculture was investigated. Adequate chemical monitoring was necessary for the optimization and quality control of this method. When methanol-carbon was not balanced with inlet nitrate-nitrogen, the column effluent was unsatisfactory for closed-system fish culture because of the presence of excess amounts of nitrite, ammonia, sulfide, and dissolved organic carbon. Column naturity and residence time also influenced sulfide production. Methane-carbon was unsatisfactory as an exogenous carbon source, and endogenous carbon did not support high removal efficiencies. Freshwater columns adapted readily to artificial seawater with a salinity of 18 o/oo without observable inhibition. Scanning electron microscopy determined that bacterial flora was mainly rod forms with the Peritricha (protozoa) as the primary consumers. Denitrifying bacteria isolated from freshwater columns were tentatively identified as species of Pseudomonas and Alcaligenes. In a pilot plant column, nitrate production was not observed. (Small-FRC)
W79-07072

PILOT PLANT INVESTIGATIONS OF SECONDARY SLUDGE DEWATERING ALTERNATIVES,
National Council for the Paper Industry for Air and Stream Improvement, Inc., Kalamazoo, MI.
R. A. Miner, D. W. Marshall, and I. Gellman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 982, Price codes: A07 in paper copy, A01 in microfiche. Technical Report EPA-600/2-78-014, 1978. 127 p, 26 fig, 32 tab, 8 ref, 5 append.

Descriptors: *Dewatering, *Sludge treatment, *Pulp wastes, *Filtration, *Centrifugation, *Performance, Separation techniques, Industrial wastes, Activated sludge, Waste water treatment.

Biological sludge thickening and dewatering alternatives were investigated on waste activated sludge resulting from the treatment of waste water from an integrated bleached kraft fine paper mill. Dewatering alternatives included pressure filtration, precoat vacuum filtration, filter belt pressing, capillary suction dewatering, gravity filtration, centrifugation, and ultrafiltration. Three levels of performance were indicated. First, pressure filtration and precoat vacuum filtration generated the driest cakes. Filter bed pressing yielded intermediate cake consistencies. Gravity filtration, centrifugation, and ultrafiltration resulted in relatively low cake consistencies. Performance was severely affected by changes in feed sludge consistency, the amount of sludge conditioning, and the sludge's specific resistance to filtration. The type and amount of sludge conditioning required was extremely variable, depending upon the dewatering technique employed, the level of performance expected, and the consistency and nature of the sludge being dewatered.
W79-07073

MEMBRANE PROCESSING OF COTTAGE CHEESE WHEY,
Cornell Univ., Ithaca, NY. Dept. of Food Science.
R. R. Zall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 251, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-118, 1977. 114 p, 25 fig, 10 tab, 6 ref, 9 append.

Descriptors: *Reverse osmosis, *Filtration, *Dairy industry, *Biochemical oxygen demand, *Membrane processes, Membranes, Separation techniques, Proteins, Cleaning, Industrial wastes, Waste water treatment.

A two-step ultrafiltration and reverse osmosis system processes 300,000 lbs/day of cottage cheese whey. Semipermeable cellulose acetate membranes operate as molecular sieves to remove proteins and lactose from the whey. The treatment process reduces effluent BOD from 40,000 mg/liter to about 2,000 mg/liter. Reverse osmosis permeate may be used to clean the whey plant when biological contaminants are adequately controlled. The system was found difficult to clean and sterilize with certain enzyme cleaners and sanitizers used. Costs for operating the plant were estimated to be about $220,000; costs for cleaners were $22,800 more than originally estimated while membrane replacement required an additional $39,600. Membranes failed more rapidly when overly exposed to or stored in sanitizing solutions and chlorinated sanitizers were harsher to membranes than quaternary ammonium compounds. The life expectancy of ultrafiltration membranes appeared to be one year rather than two while reverse osmosis membranes lasted two years. Simplification of the reverse osmosis hardware, strengthening of the ultrafiltration process, and identification of less costly cleaning methods were recommended. (Lisk-FRC)
W79-07074

EXTRACTION OR DESTRUCTION OF CHEMICAL POLLUTANTS FROM AQUEOUS WASTE STREAMS,
Texas A and M Univ., College Station.
R. R. Davison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 935, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-148, 1977. 58 p, 12 fig, 11 tab.

Descriptors: *Industrial wastes, *Waste water treatment, *Ozone, *Solvent extractions, *Organic compounds, Costs, Color, Odor, Performance, Volatility.

Solvent extraction and ozonation were used to treat various industrial waste waters. The industrial wastes were primarily light chlorinated hydrocarbon solvent wastes which were generally extracted with a high molecular weight paraffin petroleum fraction. Distribution data was also obtained on pure chlorinated compounds. The economics of solvent extraction versus steam stripping was investigated. Chlorinated solvents could be effectively removed by extraction, but stripping was more economical. Solvent extraction can compete with stripping when water solubility is higher and the volatility lower than usually encountered in such wastes. Toluene diamine can be extracted with benzene and the benzene can be steam stripped from the water. Ozone is not effective in treating glycol wastes, and it removes color and odor more rapidly than it removes TOC. The cost of treatment with ozone decreases with decreasing organic load, and the efficiency of ozone utilization decreases. (Small-FRC)
W79-07075

WASTEWATER FILTRATION DESIGN CONSIDERATIONS,
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.
J. L. Cleasby, and E. R. Baumann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 448, Price codes: A03 in paper copy, A01 in microfiche. Report EPA/625/4-74/007, 1974. 40 p, 12 fig, 4 tab, 23 ref.

Descriptors: *Filters, *Coals, *Silica, *Sands, *Design criteria, Tertiary treatment, Granules, Particle size, Head loss, Hydraulic design, Suspended solids, Filtration, Flow rates, Waste water treatment, Municipal wastes.

Filter configurations, flow controls, filter media, backwashing requirements, and head-loss developments are reviewed for polishing secondary municipal waste water. Filter material utilized singly or in multimedia filters included anthracite coal (specific gravity, 1.35-1.75), silica sand (2.65), and garnet sand (4-4.2). Conclusions of the granular filter study for secondary effluent treatment included the consideration of variable hydraulic and suspended solids loads in the filter design to avoid short filter runs and excessive backwash water requirements; the provision of a coarse-to-fine filtration system, with influent-side filter media in the particle range 1-1.2 mm, to permit penetration of suspended solids; optimization of the backwash water flow rate for fluidization of the coarser-sized grains of media; agitation of the media with air scour or surface washers to insure proper backwashing; and consideration of the effects of recycling backwash water on the filtration rate and filter operation for predicting peak loads and run lengths. Other recommendations for controlling filtration rates and terminal headloss are made depending upon the characteristics of the waste water. (Lisk-FRC)
W79-07077

LAND APPLICATION OF WASTEWATER IN AUSTRALIA. THE WERRIBEE FARM SYSTEM MELBOURNE, VICTORIA,
Environmental Protection Agency, Washington, DC. Office of Water Program Operations.
B. L. Seabrook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 454, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-430/9-75-017, May 1975. 29 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Overland flow, *Irrigation, *Oxidation lagoons, *Application methods, *Australia, Sewage lagoons, Grazing, Pasture management, Return flow, Cattle, Sheep, Treatment facilities, Waste water treatment, Municipal wastes.

The Werribee Farm in Melbourne, Australia, treats an average daily municipal waste water flow of 150 mgd with land treatment comprising land filtration, sedimentation, overland flow, and lagooning. The treatment system, in operation since 1897, cost about $1.53 per capita to operate in 1974. The land treatment system treats about 95% of the sewage from a population of 1,880,000. The farm incorporates a total area of about 27,000 acres and provides grazing land for 20,000 cattle and 10,000 sheep which have a net return of $675,000. About 38% of the sewage is treated by crop irrigation, 39% by overland flow, and 23% by oxidation lagoons. A conventional secondary mechanical treatment plant was constructed to handle about 45% of the sewage load to prevent overloading of the land treatment system. (Lisk-FRC)
W79-07078

SELECTED CHEMICAL CHARACTERISTICS OF SOILS, FORAGES, AND DRAINAGE WATER FROM THE SEWAGE FARM SERVING MELBOURNE, AUSTRALIA,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-07079

ADVANTAGES AND DISADVANTAGES OF REGIONAL SEWERAGE SYSTEMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Water Resources Bulletin, Vol. 14, No. 6, p 1449-1456, December 1978. 2 fig, 13 ref. OWRT A-048-NJ(7). 14-34-0001-8032.

Descriptors: *Sewerage, *Regional analysis, *Interceptor sewers, *Effects, *Streamflow, *Cost-effectiveness, Water quality, Land use, Planning, Urbanization, Regional development, Sewage disposal, Low flow, Sewage treatment, Pipelines.

A few years ago, many water quality administrators were convinced that large regional sewerage systems, consisting of one large treatment plant and long trunk sewers extending out to various communities, represented the only efficient and economical means of assuring water quality control. In communities favoring rapid development, the provision of sewer service and encouragement of development of new centers along the trunk sewers offered an additional advantage. More recently, quite different points of view have been arising in certain areas. In parts of New Jersey, strong environmental and community resistance has arisen to proposed central plant-trunk sewer systems. The facilitation of new development along the trunk sewers is viewed as a menace by townships not wanting intensive development of these areas. The diversion of effluent flows to trunk sewers rather than septic tanks would dry up the streams which water quality programs are supposed to protect. Both sides to the controversy have mobilized engineering, environmental, economic, and legal expertise and some critical policy issues have developed. Reconsideration of regional sewerage management and particularly trunk sewer policy is required. The decision as to extent of sewerage service areas involves complex and sensitive planning tissues. Because of potential conflicts of interest, such decisions should not be left to staffs of sewerage authorities and their design engineers. (Bell Graf-Cornell)
W79-07101

RESPONSE OF HALEY POND, MAINE, TO CHANGES IN EFFLUENT LOADS,
Maine Dept. of Environmental Protection, Augusta.
J. H. Bailey, M. Scott, D. Courtemanch, and J. Dennis.
Journal of the Water Pollution Control Federation, Vol. 51, No. 4, p 728-734, April 1979. 10 fig, 14 ref.

Descriptors: *Lakes, *Eutrophication, *Phosphorus, Nutrients, Waste water treatment, Effluents, Algae, Chlorophyll, Secchi disks, Sampling, Water quality, Hydrogen ion concentration, Alkalinity, Dissolved oxygen, Temperature, Biota, Phytoplankton, Benthos, Water quality control, Water pollution control.

When, in 1970, a secondary wastewater treatment plant began discharging effluent to Haley Pond, the lake underwent rapid eutrophication. Mean phosphorus concentration in lake water increased from 9 to 30 micrograms/liter, mean Secchi disk transparency decreased from 3.0 to 2.3 m, and intense blue-green algal blooms developed. Initiation of tertiary wastewater treatment for phosphorus removal in 1975 reduced effluent loading 97%. This quickly reversed the eutrophication, and within 2 years lake water quality approached predischarge conditions. The response of the lake to changing phosphorus loading was compared with the response predicted by a simple mass balance model, and changes in the biota during this period were documented. (Sims-ISWS)
W79-07147

FLOTATION OF INDUSTRIAL EFFLUENTS,
Marks, Dawes, Tait and Associated, Cape Town (South Africa).
R. H. Marks, and R. J. S. Thurston.
CHEMSA, Vol. 4, No. 9, p 137 and 139, September 1978. 4 fig.

Descriptors: *Waste water treatment, *Industrial wastes, *Effluents, *Flotation, Water pollution treatment, Water purification, Water quality control, Bubbles, Economics, Equations, Pressure, Velocity, Liquid wastes.

Flotation is the use of bubbles to separate finely dispersed, suspended matter close in density to that of the carrying liquid. Three types of flotation systems are used in effluent treatment: dispersed air, dissolved air, and electrolytic flotation. Dispersed air involves the introduction of gaseous air into the effluent stream by an impeller or turbine. Because these systems produce a comparatively large sized bubble, they have been found less effective than other systems. They are used only with hydrophobic materials. Air bubbles in the dissolved air system are generated by releasing the pressure on a separated, pressurized solution of air in water dissolved into either the main effluent stream or a recycle stream of treated effluent. Since these bubbles are generally much smaller than those formed by the dispersed air method, they are more efficient in flotation. The disadvantages of this system are their relatively high power consumption and the necessary maintenance of the compressors. The electrolytic generation of hydrogen and oxygen bubbles in water exhibits a slightly higher solids removal efficiency than the other two methods. Due to the absence of turbulence, the electroflotation system is highly compatible with fragile flocs. Capital costs and general maintenance for small sized plants are lower than for the other two systems. (Davison-IPA)
W79-07173

ROUTINE CONTROL OF BILHARZIA IN IRRIGATION SYSTEMS,
De Beers Diamond Research Lab., Hohannesburg (South Africa).
A. C. Evans.
The Rhodesia Science News, Vol. 12, No. 4, p 92-98, April 1978. 5 fig.

Descriptors: *Waste water treatment, *Animal parasites, *Epidemiology, *Bilharzia, *Human diseases, Dams, Drainage, Impounded waters, Weirs, Molluscicides, Snails, Water pollution sources, Water pollution treatment, Infection, Southern Africa.

The efficacy of bilharzia control methods was evaluated from studies on snail population in treated and untreated dams and data on the incidence of the disease among children on Triangle Estate and Hippo Valley Estate. Storage dams and drainage water on irrigation systems provide ideal habitats for two species of snail serving as the intermediate hosts for bilharzia. Two methods at molluscicidal application and the subsequent surveillance of drains and streams are described. Parasitological assessments reveal: (1) disease transmission is seasonal with the highest incidences occurring in the rainy to post rainy periods; (2) infection rates were lower in winter months; (3) transmission of S. mansoni was definitely linked to contact with stream courses; and (4) incidence rates were higher in villages sited close to streams. The evidence accumulated to date shows that routine snail control programs can reduce the incidence, prevalence and intensity of the infection within two years. It is concluded that each area requires its own appraisal and control program developed to suit specific conditions. (Davison-IPA)
W79-07175

MONITORING OF THE EFFLUENT STREAM FROM WASTEWATER TREATMENT PLANTS,
National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab.
R. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 393, Price codes: A02 in paper copy, A01 in microfiche. Report, 1971. 12 p, 2 fig, 1 tab.

Descriptors: *Evaluation, *Water pollution sources, *Analytical techniques, *Waste water treatment, Flow, Hydrogen ion concentration, Suspended solids, Temperature, Organic matter, Biochemical oxygen demand, Costs.

The number of measurements required to evaluate the quality of the effluent stream from a waste water treatment plant depend on the degree of precision required. Ideally, all measurements should be made on-line 24 hr/day and 365 days/yr. A minimum set of measurements which will characterize effluent with respect to impact on the receiving stream is: volume flow (mgd), water temperature, pH, suspended solids (mg/liter), and total organic concentration (COD, TOC, TOD, TC). A measurement of 5-day BOD can be substituted for total organic concentration. Instrumentation for the various measurements is discussed. When flow, water temperature, and pH are measured automatically and wet chemistry laboratory methods are used to determine COD, BOD, and suspended solids, the construction costs would be $34,361 for a 1 mgd plant and $100,111 for a 100 mgd plant. (Small-FRC)
W79-07191

LEACHABILITY OF RADIOACTIVE CONSTITUENTS FROM URANIUM MINE TAILINGS STATUS REPORT (JUNE, 1974 TO JANUARY, 1977),
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Center.
D. N. Bryant, D. B. Cohen, and R. W. Durham.
Technology Development Report EPS 4-WP-79-4, April 1979, 32 p, 13 fig, 6 ref, 8 tab.

Descriptors: *Uranium radioisotopes, *Tailwater, *Mine drainage, *Leaching, *Leachate, Radioactive waste, Sewage sludge, Effluents, Lysimeters, Settling basins, Planting management, Radiochemical analysis, Conductivity, *Acrylic lysimeters, *Polyethylene lysimeters.

A project using lysimeters to determine the leaching of radioactive constituents from abandoned uranium mine tailings, and BaRaSO4 sediments from these tailings was initiated at the Wastewater Technology Centre, Burlington, Ontario. Lime addition to the surface of acidic abandoned tailings did not reduce the level of radioactive constituents in the leachate. Considerable increases in levels of the radionuclides 230Th, 232Th and 228Th, as well as gross alpha and beta activity in the leachate, occurred five months after recycling of BaRaSO4 sediments to the surface layers of abandoned tailings. After nine months of leaching, the levels of 226Ra in the leachate were 30 percent greater from the tailings plus sediment treatment than from tailings only (control). The project was revised by increasing the high water application rate from 82 mm per month to a continuous flow of about 460 mm per month. From data obtained to date, recycling of BaRaSO4 sediments resulting from the treatment of acid seepage from abandoned tailings would appear to be undesirable because high thorium and other radioactive constituents in drainage water would require continuous treatment indefinitely. (WATDOC)
W79-07201

APPLICATION OF THE ATP ASSAY FOR MONITORING THE DISINFECTION OF WASTEWATER STREAMS,
Dearborn Chemical Co. Ltd., Ottawa (Ontario). Dearborn Environmental Consulting Service.
J. E. Cairns, S. G. Nutt, B. K. Afghan, and D. B. Carlisle.
Inland Waters Directorate, Water Quality Branch, Environment Canada, Ottawa, Canada, 1979, 18 p, 2 fig, 13 ref, 4 tab.

Descriptors: *Industrial plants, *Waste water treatment, *Chlorination, *Effluents, *Coliforms, Suspension, Analytical techniques, Biological treatment, Disinfection, Cultures, Nutrients, Poisons, Metabolism, *Adenosine triphposphate(ATP), *Plate count tests.

Plate count tests and ATP (adenosine triphosphate) assays were conducted on the following: water from waste treatment plant effluents chlorinated in the laboratory, water from waste treatment plants chlorinated by the plant facilities, and bacterial suspensions (prepared from laboratory cultures isolated from waste treatment plants) chlorinated in the laboratory. Both ATP levels and plate counts decreased in proportion to the amount of chlorine added to the water. However, the response of ATP and plate counts to the application of chlorine differed by several orders of magnitude. Despite reductions in the plate count parameters in excess of five logs (greater than 99.999%), a significant amount of the ATP was recovered in the chlorinated samples. Furthermore, the relatively insensitive response of the ATP parameter to chlorine occurred even when all the species in the sample should have been capable of growing on

the plate count media before chlorination. According to their response to nutrients and metabolic poisons, chlorinated cells which contain ATP, but are not measured by plate counts, can be metabolically active. Experiments in which chlorinated and unchlorinated cells were treated with proflavine suggest that the lethal action of chlorine, at the dosages studied, can be a site affecting DNA synthesis. An assay based on ATP techniques to measure the ability of microorganisms to attach surfaces was developed. This assay responded more sensitively to chlorination than assays of the total ATP levels of the sample. It is concluded that the ATP assay can be a useful tool in monitoring and controlling the disinfection of biological systems. (WATDOC)
W79-07203

DISINFECTION OF POULTRY PACKING PLANT EFFLUENTS SALMONELLA.
Dearborn Chemical Co. Ltd., Ottawa (Ontario). Dearborn Environmental Consulting Services.
Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-78-9, December 1978, 152 p, 9 fig, 52 tab, 8 ref, 3 append.

Descriptors: *Salmonella, *Disinfection, *Poultry, Industrial production, Industrial wastes, Waste water treatment, Chlorination, Ozone, Toxicity, Fish, Design, Operations, Operating costs, Laboratory tests, On-site tests, *Ontario, *Dechlorination.

This report is the result of an investigation to compare the relative effectiveness and economics of chlorination and ozonation for the control of salmonella in poultry processing effluents. The findings are based on laboratory and field studies conducted on the effluents from three poultry processing plants in Ontario. The surveys also were designed to assess the effect of plant design and operation on the incidence of salmonella in the final effluent. The results indicated that none of the existing treatment systems eliminated the salmonella organisms. In one instance where the processor discharged to a municipal sewer system, salmonella were isolated in anaerobically digested sludge. Chlorination and ozonation proved effective in controlling salmonella under both winter and summer operating conditions. Chlorination, however, was used successfully at a substantially lower concentration and marginally lower contact time. Chlorination increased the toxicity of the discharged effluent to fish, making dechlorination procedures necessary. Although these results were conclusive, the report indicates that disinfection requirements were site-specific. The operating costs, including amortization of capital, for ozonation were estimated at $0.17 per 1,000 1gal ($0.04 per cu. m), compared to chlorination-dechlorination costs of $0.054 per 1,000 1gal ($0.01 per cu. m). (WATDOC)
W79-07215

SINGLE SLUDGE NITROGEN REMOVAL SYSTEMS,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Center; and McMaster Univ., Hamilton (Ontario).
P. M. Sutton, B. E. Jank, B. A. Monaghan, and K. L. Murphy.
Canada-Ontario Agreement on Great Lakes Water Quality, Ontario Ministry of the Environment, Toronto, Ontario, Canada, Research Report No. 88, 164 p, 3 app, 33 fig, 63 ref, 19 tab. 1979. 75-3-21.

Descriptors: *Nitrogen, *Nitrogen fixation, *Denitrification, *Waste water treatment, *Activated sludge, Aerobic bacteria, Phosphorus, Effluents, Alkalinity, Pilot plants, Analysis.

The need for nitrogen control in the treatment of wastewater has been well documented in numerous reports and papers. Rational design approaches have been developed for nitrification in combined and separate activated sludge systems and for denitrification in separate sludge systems receiving an external carbon and energy source. Recent attention has been focused on single sludge systems which combine the processes of carbon oxidation, nitrification, and denitrification in one or more reactors without intermediate clarification and with or without the addition of an external carbon source. In this study, five different single sludge process configurations were studied at the pilot scale level. The effects of temperature, the aerobic to anoxic retention time ratio, the organic and inorganic loading conditions, the influent wastewater carbon to nitrogen ratio, and various other factors influencing nitrification and denitrification in single sludge systems were examined. The results indicate that the critical factor affecting nitrification in single sludge systems is the aerobic solids retention time. The temperature influence upon nitrification in aerobic-anoxic systems and in purely aerobic systems appears to be comparable. The denitrification rates in single sludge systems will depend on whether the reaction proceeds under noncarbon limiting or carbon limiting conditions. The organic carbon requirements in single sludge and separate sludge post-denitrification systems, to ensure no carbon limitation on the denitrification rate, are similar. (WATDOC)
W79-07219

TREATMENT OF BASE METAL MINE DRAINAGE AT PILOT SCALE,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
P. M. Huck, and B. P. LeClair.
Technology Development Report EPS 4-WP-78-4, July 1978, 80 p, 7 fig, 19 tab, 22 ref.

Descriptors: *Metals, *Mine drainage, *Sludge treatment, *Pilot plants, Lime, Neutralization, Dewatering, Effluents, Toxicity, Separation techniques, Lethality, Salmonids, *Northeastern New Brunswick.

The suitability of conventional precipitation and sedimentation techniques to remove lead, zinc, copper and iron from various types of acid mine drainage in Northeastern New Brunswick was investigated at pilot scale. The 0.3 to 1.0 L per S (4 to 13 1gpm) pilot plant was designed for lime and polymer addition, flocculation, clarification, filtration and sludge recycle. Optimum operating ranges were determined for the individual unit processes and data on attainable levels of extractable and dissolved metals are presented. Experiments were also conducted to compare two-stage lime neutralization to single stage neutralization and to investigate sludge dewaterability and effluent toxicity. Average extractable metal levels attained as clarifier overflow concentrations were 0.25 mg per L lead, 0.36 mg per L zinc, 0.05 mg per L copper and 0.28 mg per L iron. Further reductions were achieved by sand filtration. Dissolved metal levels in the clarifier overflow were approximately equal to extractable metal levels and were unaffected by further polishing. No performance advantages were discerned using two-stage neutralization compared to single stage. Sludge recycle proved to be an effective technique to increase clarifier sludge density. Sludge dewatering tests indicated that the sludge could be effectively dewatered by vacuum or pressure filtration. Bioassay tests showed median lethal times for salmonid test fish to be consistently in excess of 96 hours (the maximum period) provided that the pH was adjusted to near neutral values before tests were conducted. (WATDOC)
W79-07220

NITRIFICATION-DENITRIFICATION OF WASTEWATER USING A SINGLE-SLUDGE SYSTEM VOLUME 1,
Ontario Ministry of the Environment, Toronto.
A. G. Smith.
Canada-Ontario Agreement on Great Lakes Water Quality, Training and Technology Transfer Division (Water), Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, Research Report No. 86, 75 p, 2 app, 15 fig, 5 photographs, 17 ref, 11 tab. 1978. 71-1-20.

Descriptors: *Nitrification, *Denitrification, *Waste water treatment, Sludge digestion, Phosphorus, Aeration, Effluents, Suspended solids, Pilot plants, Nutrient removal, Sampling, Analysis, *Ontario.

Full-scale nitrification-denitrification of wastewater was conducted at the Newmarket, Ontario, Water Pollution Control Plant (WPCP), where primary stage lime treatment for phosphorus removal was being applied. The secondary treatment section was divided into two separate units, one for nitrification and the other for single-sludge nitrification-denitrification. For nine months, fall to spring, the units were evaluated under ambient environmental conditions using, for the most part, on-site equipment. The object of this study was to see what degree of nitrification-denitrification could be maintained within a system with lime treatment. Experiments involved denitrification mixed liquor thickening, methanol dosing and supplementary iron salt addition for phosphorus removal. Constant high (above 200 ml per g) sludge volume index (SVI) was experienced in both the nirification and combined nitrification-denitrification units at Newmarket. This was thought to be caused by lime addition to the primary stage. Full nitrogen conversion and removal were disrupted by sludge chlorination for SVI control. Some limitations of the conventional facility were also found to affect nitrogen removal. Supplemental addition of ferrous sulphate, late in the program, to the aeration basin improved phosphorus removal and decreased SVI. (WATDOC)
W79-07225

PRETREATMENT REGULATIONS FOR EXISTING AND NEW SOURCES OF POLLUTION,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07231

STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION IN THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07265

WHEN WATER IS THREATENED,
The Civil Engineering Contractor, Vol. 12, No. 12, p 37 and 39, September 1978. 2 fig.

Descriptors: *Water resources development, *Planning, *Rhodesia, *Dams, Riparian rights, Watersheds(Basins), Legal aspects, International, Water consumption, Water resources, Rainfall, Water storage, Storage capacity, Water yield, Water yield improvement.

Water development is a carefully planned priority in Rhodesia, a small land-locked country where the major rivers are contiguous with alien lands, or arise in one territory and flow through Rhodesia into another. Rhodesian water legislation is based on maintaining full control over the development of water resources for Rhodesian benefit, while respecting neighboring interests by providing for consultation with co-riparian states for planned development. The annual population growth rate of 3.6% necessitates careful planning, with catchment planning as the objective. Water resources are derived entirely from the annual rainfall which occurs during a few months. The existing 7,200 major and lesser dams provide a storage capacity of 3.6 x 10 to the ninth cubic meters. Long term hydrological data is being obtained from 470 recorder installations in main rivers. Large dam sites are being developed to the optimum storage capacity within the limitations of the physical features of the site and catchment yield. Currently the Ministry of Water Development has selected 310 large dam sites and developed plans for 85; 90 large dams have already been constructed. Storage capacity requirements for the turn of the century have been forecast at approximately 16 x 10 to the ninth cubic meters, or about half the optimum storage capacity required to develop the full esti-

mated potential yield of the country's water resources. Rhodesia's maximum utilization of storage/yield is 50% compared to the 80 to 100% for the U.S., Australia, and Iraq. (Davison-IPA)
W79-07345

POLLUTION FROM AGRICULTURAL AND FOOD INDUSTRIES,
Energy, Vol. 4, No. 4, p 20-21, April/May 1978.

Descriptors: *Waste water treatment, *Water reuse, *Water pollution treatment, *Food processing industry, *Waste treatment, Effluents, Anaerobic digestion, Aerobic treatment, Activated sludge, Waste treatment plants, Microbial degradation, Biodegradation, Sludge digestion, Wastes, Water pollution sources, Industrial wastes, Liquid wastes, Organic wastes, Organic matter, Organic compounds, Water pollution.

The volume and quantity of pollution from the agricultural and food industries varies according to the type of activity, production process, tonnages involved, the season, and even the day and time of day. The effluent, essentially organic in composition often has a high DCO and DBO5 content. The known waste treatments must be adopted to the individual segments of the agricultural and foodstuffs industries. Water recycling techniques have been intensively studied in France in recent years, and a number of plants are effectively treating waste water for internal reuse. The Adour-Garbonne basin authorities report a 60% reduction in the amount of water to be treated from a cooked meat and vegetable preserving plant. The increase of large scale food production units over the last 15 years has necessitated the construction of purification stations for their effluents. These purification stations generally utilize microbial degradation in the form of aerobic treatment or anaerobic digestion. The performance of these stations varies with the material and the number of recycling operations used; efficiency ranges between 40 and 65% for heavy and medium loads. Difficulties encountered in separating the bacterian agglomerates of processed water by simple decantation are known as 'festering expansion' of the activated sludge. Research on these difficulties and the techniques of operating purification stations has been carried out by the Institut National de la Lecherche Agronomique. (Davison-IPA)
W79-07356

THE 'BIOPOT' -- GOOD RURAL HYGIENE,
Development Magazine, Vol. 12, No. 14, p 43, June 1978. 1 fig.

Descriptors: *Waste treatment, *Biodegradation, *Aerobic treatment, *Anaerobic digestion, Filters, Neutralization, Calcium carbonate, Pollution abatement, Organic wastes, Odor, Air pollution, Rural areas, Waste disposal.

A closed lavatory system is described which reportedly does not contaminate groundwater, the soil or the air, and requires no transportation of the wastes. Two stages of biochemical treatment are involved: aerobic decomposition and an anaerobic decomposition and an anaerobic process which eliminates dangerous microorganisms. Because the main treatment is a composting process and bulk household garbage can also be treated, a very concentrated rich manure is yielded. The 'biopot' is based on a filter system consisting of three layers: the first is coarse sand and leaves for trapping solid particles in the fluid; the second consists of crushed limestone and ashes to neutralize the acids; the third is coarse sand and charcoal to trap remaining organisms and particles. The filter is placed on a perforated stone slab which is a permanent part of the construction. The 'biopot' is designed for outlying and poor rural areas; its advantages are listed. (Davison-IPA)
W79-07358

DETERMINATION OF INORGANIC AND TOTAL MERCURY, IN WATER AND EFFLUENTS BY FLAMELESS ATOMIC ABSORPTION, (BEPALING VAN ANGORGANIESE EN TOTALE KWIK IN WATER EN ULTVLOEISELS DEUR VLAMLOSE ATOOMABSORPSIE,)
National Inst. for Water Research, Pretoria (South Africa).
D. J. Huyser, and R. G. Bohmer.
Water S. A., Vol. 4, No. 2, p 76-80, April 1978. 3 fig, 27 ref.

Descriptors: *Waste water treatment, *Spectrophotometry, *Flame photometry, *Mercury, *Absorption, *Water pollution sources, Sewage, Acids, Digestion, Temperature, Organic compounds.

The flameless, or cold vapor, method was used to determine inorganic and total mercury in water samples with varying amounts of pollution. Since not all methods for determining inorganic mercury can be applied to all types of water, special care must be taken with sewage samples. Recovery of mercury added to settled sewage was very low with the method used, even after varying quantities of different inorganic acids were added. The investigation of three digestion procedures for determining total mercury involved the use of varying quantities of oxidizing agents and acid and different digestion temperature and times. Results showed that oxidizing agent must be present; digestion must take place at high temperatures. (Davison-IPA)
W79-07360

TIOGA RIVER MINE DRAINAGE ABATEMENT PROJECT,
Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, PA.
A. F. Miorin, R. S. Klingensmith, R. E. Heizer, and J. R. Saliunas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 507, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/7-79-035, February 1979. 96 p, 28 fig, 21 tab, 4 ref, 2 append. S805784 (14010 HIN).

Descriptors: *Mine wastes, *Water pollution control, *Pollution abatement, *Mine drainage, *Strip mines, Sludge, Soil chemistry, Acid mine water, Limestones, Channel improvement, Monitoring, Flow, Inspection, On-site investigations, Evaluation, Economic feasibility.

Information and data are evaluated from the implementation of a mine drainage abatement demonstration project in two sections of a mined area near Morris Run Village, Tioga County, Pennsylvania. Effective mine drainage abatement techniques were demonstrated, a specific mine drainage problem was reduced, and portions of a strip mined area were restored almost to their original surface grades. The following techniques were demonstrated: the restoration of strip pits utilizing agricultural limestone and waste water sludge as soil conditioners; the burial of acid forming materials within restored strip mines; and the reconstruction and lining of a stream channel. Monitoring program data comparing associated flows and loadings before and after construction were used to determine the effectiveness of the project in reducing drainage discharge. The effectiveness of the design and construction methods was documented through on-site inspections, photography during project evaluation, and precipitation and flow measurements. The economic feasibility of these abatement measures was evaluated. The project resulted in an estimated acid reduction of 862 kilograms/day under average groundwater conditions from one of the sites. Results for the other site could not be confirmed due to gaps in the monitoring data. Reductions of 13 and 16% in acidity concentrations from the mine drainage discharges were documented. (Davison-IPA)
W79-07368

INTEGRATED SEWAGE TREATMENT SYSTEM,
R. H. Nealy.
U.S. Patent No. 4,135,665, 7 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 4, p 1270, January 23, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Domestic wastes, Disinfection, Incineration, Equipment.

An on-site system for treating domestic sewage generated within a building is totally integrated with means for modifing space temperatures and for heating water for sanitary and other purposes to form a matrix of interrelated and interdependent functions acting together to deliver only non-polluting products to the environment and to achieve maximal energy conservation. The system extracts energy from sewage solids and organic wastes by incineration and thereby produces a net reduction in the aggregate fuel demand. The system also employs pressurized, liquid-phase thermal sterilization to treat the liquid sewage. (Sinha-OEIS)
W79-07397

COMPACT APPARATUS FOR THE PURIFICATION OF WASTE WATER BY A PHYSICAL CHEMICAL TREATMENT,
Degremont, Rueil-Malmaison (France). (Assignee).
R. Louboutin, and V. Savall.
U.S. Patent No. 4,136,012, 6 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1385, January 23, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Sewage treatment, Separation techniques, Neutralization, Coagulation, Flocculation, Sludge, Equipment, Flow-around objects.

A single, integrally formed tank has an upper portion of a rectangular configuration and a lower portion of downwardly decreasing volume defined by exterior walls, at least two of which are inclined downwardly and inwardly toward each other. The interior of the tank is divided into three serially connected compartments by means of interior walls which are inclined in directions substantially parallel to one of the inclined exterior walls. The compartment thus formed are a first, neutralization and coagulation compartment, a second, flocculation compartment, and a third, lamellar decanting and sludge settling compartment. Within the flocculation compartment are arranged spaced inclined plates defining upwardly inclined flow passages into which extend deflectors to create eddy currents in the water passing upwardly through the flocculation compartment. Within the decanting compartment are arranged inclined hollow tubes which facilitate downward settling of sludge and upward movement of the decanted water. (Sinha-OEIS)
W79-07402

METHODS AND APPARATUS FOR TREATING WASTEWATER,
Airco, Inc., Montvale, NJ. (Assignee).
B. S. Kirk, and R. M. Chappel.
U.S. Patent No. 4,136,023, 19 p, 9 fig, 13 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1388-1389, January 23, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Oxygen, Activated sludge, Oxygenation, Equipment, Biological treatment.

This invention provides improved methods and apparatus for dissolving oxygen in wastewater treatment processes such as is required to satisfy the biological oxygen demand in the activated sludge process for the biodegradation of organic impurities. The invention enables attainment of high concentrations of dissolved oxygen with minimum consumption of oxygen and power. Wastewater with the high concentration of dissolved oxygen may be mixed with a larger volume of untreated wastewater to achieve the desired oxygen concentration and maintain volatile solids in suspension in the bulk liquid for optimum efficiency of purification. Oxygenation takes place within the unit by causing the stream of water entering the unit to pass into a pocket of oxygen rich gas maintained within the unit and impinge on

the surface of the water adjacent the trapped pocket of gas in a confined turbulent zone. Parameters are established to assure adequate residence time for the stream in the turbulent zone, after which the stream enters a more quiescent zone which allows undissolved oxygen to escape from the water and return to the gas pocket for reuse. The water containing a high level of dissolved oxygen is then directionally discharged at a predetermined velocity to mix thoroughly with the main body of wastewater. (Sinha-OEIS)
W79-07403

APPARATUS FOR AUTOMATICALLY SENSING AND RECORDING DATA IN A SEWAGE SYSTEM,
Tetradyne Corp., Carrollton, TX. (Assignee).
F. N. Mueller, and R. W. Chandler.
U.S. Patent No. 4,136,561, 15 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1575, January 30, 1979.

Descriptors: *Patents, *Control systems, *Automatic control, Monitoring, Data collection, Data storage and retrieval, Flow rates, Rainfall, Sewage monitoring system, Water depth.

A control module having circuitry for generating control and timing signals and for receiving digital data is described. Sensor modules are connected to the control module and each contains devices for sensing various physical characteristics such as flow rate, water level, rainfall or the like. In response to control signals generated by the control module, each of the sensor modules is operable to input digital data representative of the sensed physical characteristics to the control module. A recorder is connected to the control module and includes a removable recording cassette for recording the digital data transmitted from the sensor modules. The recorder also records the identification of the sensor module transmitting data, along with the calendar day and the time of day that the data was transmitted. This system solves the existing needs for an automatic monitoring system for sewage environment. (Sinha-OEIS)
W79-07408

PROCESS FOR TERTIARY TREATMENT OF WASTE WATERS FROM ANAEROBIC DIGESTION TREATMENT PROCESS,
Hitachi, Ltd., Tokyo (Japan). (Assignee).
M. Ishida, R. Haga, and Y. Odawara.
U.S. Patent No. 4,137,158, 9 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1767-1768, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Tertiary treatment, Anaerobic digestion, Equipment, Ammonia, Nitrogen, Phosphate, Activated sludge, By-products, Fertilizers, Biochemical wastes.

A process for the tertiary treatment of biochemical waste waters comprises the following main steps: (1) adding milk of lime to waste water from the anaerobic digestion treatment process to render the waste water alkaline and recovering NH3 by reduced pressure distilation; (2) contacting recovered NH3 with a weakly acidic ion exchange resin to make NH3 adsorbed in the ion exchanger resin; (3) adding acid to the adsorbed ammonia to form an ammonia salt; and (4) blowing CO2 into the treated water from which NH3 has been removed, to recover P, and subjecting the treated water from which N and P have been removed to the activated sludge treatment to remove BOD. Since the digestion gas generated as a by-product can be used as the energy source of the treatment apparatus, the treatment cost is low, and the digestion sludge discharged as a by-product can be used as a high quality organic fertilizer. (Sinha-OEIS)
W79-07411

METHOD FOR TREATING WASTE WATERS,
Nippon Oil Co., Ltd., Tokyo (Japan). (Assignee).
M. Mohri, H. Takeda, M. Tsunemi, T. Uchiumi, and T. Kanda.
U.S. Patent No. 4,137,162, 6 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1769, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oily water, Activated carbon, Oxygen, Chemical oxygen demand, Fluidized bed, Bilge water.

A method for treating waste waters to remove oils and/or COD comprises accomodating solid porous packing pieces and activated carbon particles in a container, the porous packing pieces forming a stationary porous packed bed, the average pore diameter being 1.5 to 8 times the average diameter of the activated carbon particles. The waste water is introduced together with an oxygen-containing gas and/or an oxidizing gas, from the bottom portion of the container to fluidize the activated carbon particles within the pores of the porous packing pieces and in spaces among the adjoining packing pieces and simultaneously to contact the waste water with the activated carbon particles. The upper level of the fluidized bed of the activated carbon particles is maintained at least 5 cm below the upper level of the porous packed bed. The treated water is withdrawn from the top portion of the container. (Sinha-OEIS)
W79-07412

TREATMENT OF VEGETABLE TANNING WASTES,
Eberle Tanning Co., Westfield, PA. (Assignee).
H. H. Young.
U.S. Patent No. 4,137,163, 7 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1769, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Tannery wastes, Separation techniques, Color, Suspended solids, Flocculation, Polymers, Alakaline water, Combustion gases, Scrubbing.

Highly colored tannin bodies and other suspended solids are separated from highly alkaline vegetable tannery waste effluent by scrubbing hot combustion gas with the effluent, introducing polyacrylamide flocculant into the effluent either immediately before scrubbing or during scrubbing, and separating floatable foam and settleable solids from the effluent after scrubbing. The effluent may be treated with a soluble salt of a trivalent metal before scrubbing to act as a primary flocculant. (Sinha-OEIS)
W79-07413

PROCESS FOR CLARIFYING IRON ORE SLIMES,
American Cyanamid Co., Stamford, CT. (Assignee)
A. T. Coscia, and M. N. D. O'Connor.
U.S. Patent No. 4,137,164, 7 p, 4 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1770, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Mine wastes, Separation techniques, Suspended solids, Iron, Flocculation, Polymers, Adsorption, Iron ore slimes.

The process employs a polyacrylamide chemically modified to contain certain quaternized dimethylaminomethyl groups and of low molecular weight. The ore slimes which are effectively clarified by these polymers are those which contain up to about 100,000 parts per million of suspended inorganic solids. The process is particularly effective in the clarification of iron ore slimes. After the chemically-modified polymer has been mixed with the slime, small absorbent flocs involving part of the suspended solids will immediately form. These flocs, because of their nature, can be kept in suspension by application of suitable agitation, usually slow speed, and while in suspension will adsorb additional suspended solids. After the suspendible flocs have adsorbed a suitable amount of the remaining solids in suspension, the resulting flocs are allowed to settle. The clarified water may be decanted or otherwise recovered in accordance with conventional procedures. (Sinha-OEIS)
W79-07414

PROCESS FOR THE PURIFICATION OF WASTE WATER CONTAINING AMMONIA AND AMMONIA SALTS,
Deutsche Gold- and Silver-Scheideanstalt A. G., Frankfurt-am-Main (Germany, F.R.) (Assignee).
W. Heimberger, and H. Schmitt.
U.S. Patent No. 4,137,166, 5 p, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1770, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, Ammonia, Ammonium salts, Hydrogen ion concentration, Neutralization, Nitrogen, Alkali metals, Alkaline earth metal hypochlorites.

Waste water which contains ammonia or ammonium salts can be purified with alkali metal or alkaline earth metal hypochlorites quantitatively in a very short time and without formation of the explosive nitrogen trichloride if the waste water is adjusted to an initial pH of 8-10.5 with an alkaline material and then treated with an amount of alkali metal or alkaline earth metal hypochlorite in an amount practically equivalent to the ammonia or ammonium ion content. By adjustment of the pH before addition of the hypochlorite solution to at least 8 and maintaining a pH of about 6-8 during the entire reaction, i.e., up to the end of the development of nitrogen, the development of nitrogen trichloride which has always been observed in the past is completely suppressed. (Sinha-OEIS)
W79-07416

PROCESS FOR TREATING WASTE WATER AND AN APPARATUS THEREFOR,
Ishigaki Kiko Co., Ltd., Tokyo (Japan). (Assignee).
I. Yokata.
U.S. Patent No. 4,137,171, 18 p, 21 fig, 1 tab, 12 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1772, January 30, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Biologic treatment, Microorganisms, Microbial degradation, Aerobic conditions, Equipment, Mesh net units.

Waste water to be purified is brought successively into contact with a number of net units which are arranged in a treating tank with certain intervals between them. Organic substances in the waste water are removed due to decomposition, which adhere to the net units. Contact area between the organic substances and the microorganisms is large, and various kinds of microorganisms propagate. Water is recirculated by the aid of air jetting from nozzles. Simultaneously dissolved oxygen in the waste water is enriched by the air supplied by the air-jetting nozzles. Thus, removal of the organic substances proceeds effectively and promptly. An apparatus which is suitable for carrying out the process is also proposed. (Sinha-OEIS)
W79-07417

CHARGED MEMBRANE, LOW PRESSURE ULTRAFILTRATION TO TREAT ACID MINE DRAINAGE WATERS,
Kentucky Water Resources Research Center, Lexington.
D. Bhattacharyya, R. B. Grieves, and S. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 209, Price codes: A09 in paper copy, A01 in microfiche. Research Report No. 120, 1979. 178 p, 51 fig, 31 tab, 56 ref. OWRT B-050-KY (1), 14-34-0001-7160.

Descriptors: *Acid mine water, *Membrane processes, Chemical precipitation, Water reuse, Reverse osmosis.

Low-pressure ultrafiltration with negatively-charged, non-cellulosic membranes is shown to be a feasible process in terms of achieving the simultaneous separation of dissolved metals (and sulfate) and of suspended solids from acid mine drainage

water. The process is evaluated in terms of the simultaneous achievement of good water flux without membrane fouling and of adequate ultrafiltrate quality at high water recovery for water reuse operation. At a transmembrane pressure of 5.6 x 105 N/m2, water fluxes in the range of 5.8 x 10-4 cm/sec to 12.5 x 10-4 cm/sec could be obtained at 97% water recovery. The results of the ultrafiltration investigations are compared with the reported results from lime precipitation-settling and reverse osmosis treatment field studies in terms of treated water quality, reusability, concentrated (sludge) production rates, water recovery and membrane flux behavior. With a lime precipitation-settling process the treated water would be saturated with calcium sulfate.
W79-07424

STORM WATER CHARACTERISTICS OF SOME ROTTERDAM SEWERAGE DISTRICTS,
Dienst Gemeentewerken, Rotterdam (Netherlands).
G. van der Kroon.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 292-302, 1977. 5 fig, 3 tab, 5 ref.

Descriptors: *Storm water characteristics, *Sewerage districts, *Rotterdam(The Netherlands), *Waste water treatment, *Water quality, Pumping, Comprehensive planning, Rivers, Treatment facilities, Surface waters, Runoff, Design criteria, Overflow, Mathematical models, Cost saving.

The cost of connecting the old quarters of Rotterdam to a wastewater treatment plant was estimated to be one hundred million guilders in 1971, including the costs of new high pressure mains to connect the existing pumping stations to the water treatment plant, upgrading these stations (13 to them), reconstructing sewers, and so forth. This explains why urban drainage systems deserve more interest and study. To be successful, such a study must be done on a full technical scale. It is expected that this study will result in the collection of many important data which may reduce the cost; rational solutions to the comprehensive plan will be yielded with respect to sewage treatment. The pumping system of Rotterdam needs the concept of storm water overflow pumps to the river to maintain a low storm water overflow frequency to the surface water inland of the embankment of the river and to maintain a reasonable storm water pumping rate to the wastewater treatment plant. The storm water overflow pumping system has the following advantages: (1) a reduction of pollution of the inland surface water (i.e., canals) in the center of the city; (2) a reduction of the total quantity of rinsewater needed for maintaining the quality of the water in the canals; (3) a reduction of the storm water pumping rate to the wastewater treatment plant. (See also W79-07426) (Bell Graf-Cornell)
W79-07457

CLOSED WATER-USE CYCLES IN URBAN INDUSTRIAL COMMUNITIES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. S. Kaminskii.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of Amsterdam Symposium, October, 1977. IAHS-AISH Publ. No. 123, Intern. Assoc. of Hydrological Sciences, p 448-454, 1977.

Descriptors: *Water quality control, *Recycling, *Industries, *Waste water(Pollution), *Treatment facilities, *Closed water-use cycles, Urban development, Freshwater, Water supply, Economic efficiency, Effluents, Standards, Industrial communities, Wasteless technology, USSR.

The growth of industrial communities causes difficulties in their freshwater supply. Under such conditions, the main task is the creation of closed water-use cycles in industrial plant (introduction of technology without waste water), these cycles being the first stage of the creation of wasteless processes. It is necessary in the future to include additionally treated municipal waste water in industrial and communal water recycling systems. The development of industrial and municipal closed water-use systems in urban communities is quite possible from the technological and sanitary-hygienic points of view, and it is socially and economically advisable. (See also W79-07426) (Bell Graf-Cornell)
W79-07475

THE MEANS AND PROBLEMS OF PREVENTING POLLUTION OF SURFACE WATERS BY WASTE WATERS FROM CITIES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
O. T. Bolotina.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 471-477, 1977. 2 fig, 1 tab, 8 ref.

Descriptors: *Surface waters, *Water pollution control, *Municipal wastes, *Waste water treatment, Standards, Water conservation, Industrial wastes, Evaluation, Water bodies, Waste water(Pollution), Domestic wastes.

A most urgent task for water conservation is to stop the pollution of water bodies by waste water discharged by sewers from large industrial cities. Presently, industrial wastes are prevalent in urban waste water, but a substantial decrease in the quantity of these is expected. Also, the volume of domestic waste water is expected to increase because houses will be more modern. By analyzing the present situation and evaluating future trends, the joint treatment of domestic and industrial waste waters is recommended. The processes responsible for the quality of water bodies depend on various factors, with the decisive one being the discharge of urban waste water. It is essential for pollution control to start at the sources of the pollutants and that the observance of standards established for all stages of the collection and treatment of waste waters be strictly supervised. For future techniques, the classical complete biological treatment of urban waste waters will be adequate to preserve the quality of water in lakes and reservoirs. Supplementary treatment by filtration through sand is perhaps necessary in some cases. The extraction of biological substances will be necessary for large flows of waste water with high concentrations of pollutants. A strict observation of established standards for the composition of industrial effluents which discharge into the sewerage network is imperative. For self-purification of water bodies, the waste waters discharged into them must first undergo biological treatment. (See also W79-07426) (Bell Graf-Cornell)
W79-07478

5E. Ultimate Disposal Of Wastes

SURFACE WATER QUALITY AND BUILT-UP AREAS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07021

DISPOSAL OF SOLID WASTES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07022

NONSEWERED BUILT-UP AREAS AND SEPTAGE DISPOSAL SITES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07025

INDUSTRIAL AREAS AND GROUND DISPOSAL OF INDUSTRIAL WASTES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07026

EVALUATION OF LAND APPLICATION SYSTEMS,
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 440, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-430/9-75-001, 1975. 194 p, 4 fig, 15 tab, 185 ref, 7 append.

Descriptors: *Application methods, *Land use, *Ultimate disposal, *Return flow, *Operation and maintenance, Treatment facilities, Design criteria, Sites, Waste water treatment, Waste water disposal, Municipal wastes.

Procedures are outlined for EPA personnel for the application of municipal waste water to land. An evaluation checklist and relative background information are provided. Sections are included on facilities plans, design plans and specifications, and operation and maintenance manuals. The first section provides a thorough evaluation of land application alternatives and the preparation of a detailed facilities plan as well as evaluations of potential sites, land application alternatives, design considerations, and environmental factors. The second section describes procedures for evaluating design plans and specifications with emphasis on the agreement of the facilities design with the conditions of the particular site. The third section outlines special considerations for land application systems with respect to operating procedures, monitoring requirements, and impact control. (Lisk-FRC)
W79-07028

RECOVERY OF VIRUSES FROM THE MISSOURI RIVER,
Environmental Protection Agency Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W79-07031

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07061

COST AND EFFECTIVENESS COMPARISONS OF VARIOUS TYPES OF SLUDGE IRRADIATION AND SLUDGE PASTEURIZATION TREATMENTS,
Sandia Labs., Albuquerque, NM.
M. E. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-76-5780, Price codes: A03 in paper copy, A01 in microfiche. Report, 1976. 18 p, 2 fig, 6 tab, 3 ref.

Descriptors: *Sewage sludge, *Disinfection, *Irradiation, *Heat treatment, *Thermal radiation, Capital costs, Cost analysis, Comparative costs, Pathogenic bacteria, Viruses, Salmonella, Sewage bacteria, Municipal wastes.

Gamma irradiation and thermoradiation were compared with heat pasteurization for the disinfection of both liquid and dry sludges. Heat pasteurization of sludge is conducted at 70C for 30 min. The irradiation process utilizing cesium-137 treats the sewage sludge with 1 megarad with simultaneous oxygenation of the sludge. Thermoradiation to disinfect the sludge is conducted at 55C with 300 kilorads for 5 min. Irradiation effectively inactivated pathogens in the sludge except viruses. Ther-

moradiation utilized temperatures high enough to kill the virus population. In dry sludge with a moisture content of 30-50%, heat and irradiation inactivation of salmonella occurred at rates comparable to treatment of liquid sludges. For a 4.2 ton/day sludge disinfection plant, capital costs were estimated at: $98,600 for pasteurization, $536,000 for irradiation, and $571,000 for thermoradiation. For a 20.8 ton/day plant, capital costs were: $236,200 for pasteurization, $678,000 for irradiation, and $856,000 for thermoradiation. However, irradiation and thermoradiation are more energy conserving than pasteurization, and irradiation may be less expensive than the other two disinfection processes; heat treatment and thermoradiation costs are comparable for the larger plant sizes. The irradiation of dry composted sludge was considered more practical and less costly than any of the liquid sludge treatment methods. (Lisk-FRC)
W79-07067

NITRATE LEACHING IN A SLUDGE-TREATED FOREST SOIL,
Science and Education Administration, Morgantown, WV.
For primary bibliographic entry see Field 2G.
W79-07142

AN APPRAISAL OF UNDERGROUND RADIOACTIVE WASTE DISPOSAL IN ARGILLACEOUS AND CRYSTALLINE ROCKS: SOME GEOCHEMICAL, GEOMECHANICAL AND HYDROGEOLOGICAL QUESTIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
J. A. Apps, G. W. Cook, and P. A. Witherspoon.
Geotechnical Assessment and Instrumentation Needs Symposium, July 16-19/19-30, 1978, Berkeley, California, Lawrence Berkeley Laboratory, Earth Science Division, University of California, Berkeley. 1978. 50 p, 10 fig, 9 tab, 29 ref.

Descriptors: *Radioactive waste disposals, *Underground waste disposals, Engineering geology, Hydrogeology, Geochemistry, Storage, Stress, Hydraulic conductivity, Hydraulic gradient, Groundwater movement, Leaching, Waste dilution, Adsorption, Crystalline rocks, Shales.

Radioactive wastes are being stored in increasing quantities at surface and near surface sites. Deep burial of these wastes is the most favorable alternative method of disposal. This paper appraises the potential for underground storage of radioactive wastes and defines the more significant factors affecting the selection and design of a repository. Those areas of geomechanics, hydrogeology, and geochemistry where further research is needed are identified. The geomechanical stability of a suitable repository site depends in general on the absence of major geological perturbations, and specifically, on a state of stress conducive to stability. The most likely means by which radioactive materials could be released to the biosphere is through transport by ground water in joints and fractures. This release is retarded by low hydraulic conductivity, small hydraulic gradients, long flow paths, leaching of the waste by groundwater, dilution, and sorption in the rock mass. Argillaceous and crystalline rocks may provide suitable sites for nuclear wastes repositories. (Purdin-NWWA)
W79-07196

PRETREATMENT REGULATIONS FOR EXISTING AND NEW SOURCES OF POLLUTION,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07231

THE CLEAN WATER ACT OF 1977 - MODIFICATIONS OF THE MUNICIPAL PROGRAM,
For primary bibliographic entry see Field 6E.
W79-07268

WHEN WATER IS THREATENED,
For primary bibliographic entry see Field 5D.
W79-07345

ANALYSIS OF SAND SAMPLES FROM THE SAND ISLAND SEWER OUTFALL, MAMALA BAY, O'AHU (INTERIM PROGRESS REPORT),
University of Hawaii at Honolulu, Hawaii. Water Resources Research Center.
S. A. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 145, Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum Report No. 60, May 1978. 19 p, 2 fig, 2 tab, 3 ref, append.

Descriptors: *Invertebrates, *Benthic fauna, Annelids, Marine algae, Chlorophyta, Coral, Mollusks, Hawaii, Sampling, Sewage outfall, Sand, Foraminifera, Pinna semicostata, Chaetopterus, Mamala Bay, Oahu.

Sand grab samples were collected from nine locations at and around existing and proposed ocean sewage outfalls and at a control station. The preserved samples were analyzed for abundance of invertebrates. Stations in the vicinity of the existing outfall (12 m deep) were characterized by high abundance of annelid tube worms which grew in huge, densely packed clusters. Foraminfera and the green algae Halimeda sp. were absent or in relatively low abundance. In the vicinity of the proposed outfall (65 m deep), samples contained high abundance of Halimeda sp., moderate quantities of Foraminifera, and the solitary coral Fungia fragilis; no annelid worms were found. This pattern of abundance was similar to the control station. The pen shell Pinna semicostata was present at most deep water stations. Extensive beds of this mollusk are common in other regions along south O'ahu.
W79-07394

5F. Water Treatment and Quality Alteration

MAGNETIC WATER CONDITIONERS: ARE THEY FOR REAL,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 6, p 32-33, June, 1979.

Descriptors: *Water treatment, *Scaling, *Magnets, Water softening, Aesthetics, Corrosion, Descaling, Rusting, Laboratory tests, Taste, Odor, Water structure.

Magnetic or electrostatic water conditioners claim to eliminate encrustation and corrosion problems due to various causes, solve taste and odor problems caused by hydrogen sulfide and increase dissolved oxygen content of water. The mechanics of these systems involves the use of magnets to modify the molecular structure of water so that scale and/or rust is prevented from adhering to pipes. However, after extensive testing by the author, no evidence was found to support the manufacturer's performance claims. Other researchers have noted that magnetic treatment of water produces a less adhesive, more friable scale during laboratory tests. However, similar tests performed by the U.S. Naval Engineering Experiment Station failed to reveal any reduction in scale formation. (Purdin-NWWA)
W79-07194

IODINE FOR DISINFECTION,
B. Whitehead.
Canadian Water Well, Vol. 5, No. 2, p 9-10, May, 1979. 3 fig, 3 ref.

Descriptors: *Disinfection, *Iodine, *Water purification, Water treatment, Domestic water, Water supply, Chlorination.

Iodine has been used to sterilize water since the early 1900's. Until recently, its use has been restricted to emergency or periodic use. Prolonged use of iodine was shown to have no adverse effects and presently it is being used increasingly for treatment of individual water supplies. Iodine treatment systems can use iodine crystals on a complexed iodine liquid. The concentration of iodine and the contact time required for disinfection is temperature dependent. Under fluctuating consumption conditions, the temperature in the contact tank will vary. Therefore, tank volume and the minimum concentration of iodine must be based on the minimum water temperature. Iodine up to 1.5 mg/l imparts no observable taste or odor. Iodine is relatively inert with respect to ammonia and other organics such that iodamines are not formed as chloramines (potential carcinogens) are formed by chlorination. High organic contents in water creating high iodine demands may, however, preclude the use of iodine for disinfection. Carbon filtration removes iodine and therefore any potential negative effects of iodination. There is, however, no residual to maintain the bacterial integrity of the system. Long term physiological effects of iodination are as yet uncertain, particularly in children, and more research is needed. (Purdin-NWWA)
W79-07199

EVALUATION OF PHYSICAL-CHEMICAL TECHNOLOGIES FOR WATER REUSE, BY-PRODUCT RECOVERY AND WASTEWATER TREATMENT IN THE FOOD PROCESSING INDUSTRY.
Dearborn Environmental Consulting Services, Mississauga (Ontario).
Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Ottawa, Canada, April, 1979, Economic and Technical Review Report EPS 3-WP-79-3, 172 p, 37 fig, 17 ref, 12 tab.

Descriptors: *Water reuse, *Waste water treatment, *Waste water management, *Food processing industry, Effluents, Quality control, Byproducts, Pollution abatement, Technology, Econometrics, Chemcontrol, Physical control.

Physical-chemical treatment systems can be incorporated into the process line of an industry or may be used to enhance an existing treatment system. The more consistent effluent quality from physical-chemical treatment systems makes them amenable to byproduct recovery or water reuse schemes. While many such systems are more expensive than conventional treatment, the prospect of valuable byproduct recovery makes them more attractive. The objective of this manual is to provide a comprehensive review of physical-chemical and advanced treatment technologies and their application to the food industry. Such documentation should provide food industry personnel with valuable information on treatment alternatives available to meet their specific needs. A general section covering the economic considerations is included to augment the design criteria. Case histories from the majority of the food industry have been included to add operational information. (WATDOC)
W79-07209

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07241

UNNECESSARY AND HARMFUL LEVELS OF DOMESTIC SEWAGE CHLORINATION SHOULD BE STOPPED,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07262

HOW TO COPE WITH THE SAFE DRINKING ACT,
Texas Univ. at Austin. Lyndon B. Johnson School of Public Affairs.
For primary bibliographic entry see Field 6E.
W79-07264

PROCEEDINGS, NORTH CAROLINA 208 PROBLEM ASSESSMENT WORKSHOP, MAY 4, 1977, RALEIGH,
For primary bibliographic entry see Field 6B.
W79-07391

METHOD FOR TREATING WATER,
Osaka Gas Co. Ltd., (Japan). (Assignee).
Y. Sakamoto, M. Kinugasa, S. Endo, M. Yamane, and S. Fujie.
U.S. Patent No. 4,136,027, 9 p, 2 fig, 14 tab, 4 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1389-1390, January 23, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, Adsorption, Ozone, Oxidation, Gases, Silica gel.

When an ozone-containing gas prepared by an ozone generator from a gas having a higher oxygen content than air is supplied at atmospheric or elevated pressure to an adsorption tower packed wil silica gel, ozone is selectively adsorbed by the silica gel in preference to the other gas components and is thereafter desorbable by a carrier gas fed to the adsorption tower at a pressure lower than the pressure applied for the adsorption to give a gas having a higher ozone concentration than the above-mentioned ozone-containing gas. When the ozone-containing carrier gas is brought into contact with the water to be treated, the water absorbs an increased amount of ozone and can be treated with greatly improved efficiency. The gas from which the ozone is removed is recycled to the ozone generator and is reused as a portion of the starting material. Further research shows that employing three to four adsorption towers, such that in order to purge one tower of the carrier gas after the desorption step which tower is at a reduced pressure, a portion of oxygen-containing gas in another tower of a higher pressure is used, whereby the oxygen consumption can be materially reduced. Based on these findings this invention accomplished a method of treating water on an industrial scale. (Sinha-OEIS)
W79-07405

PROCESS FOR CLARIFYING RAW WATER,
American Cyanamid Co., Stamford, CT. (Assignee).
A. T. Coscia, and M. N. D. O'Connor.
U.S. Patent No. 4,137,165, 6 p, 9 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 5, p 1770, January 30, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, Suspended solids, Polymers, Flocculation, Turbidity, Adsorption, Raw water.

Use of a low molecular weight polyacrylamide modified to provide quaternized dimethylaminomethyl groups in the clarification of raw water produces improved clarification. After the chemically-modified polymer has been mixed with the raw water, small absorbent flocs involving part of the suspended solids will immediately form. These flocs, because of their nature can be kept in suspension by application of suitable agitation and will adsorb additional suspended solids. After the suspendible flocs have adsorbed a suitable amount of the remaining solids in suspension, the resulting flocs are allowed to settle, thus providing supernatant clarified water and a sediment of flocculated inorganic solids. The clarified water may be decanted or otherwise recovered. (Sinha-OEIS)
W79-07415

5G. Water Quality Control

RESEARCH INITIATION--OPTIMAL CONTROL OF ARTIFICIAL AERATION IN POLLUTED RIVERS,
Columbia Univ., New York.
R. W. Longman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 346, Price codes: A07 in paper copy, A01 in microfiche. Report, 1976. 126 p, 2 fig, 85 ref, 1 append.

Descriptors: *Aeration, *Rivers, *Water pollution treatment, *Abatement, *Water quality, Costs, Statistical models, Stochastic processes, Oxygen.

The direct introduction of oxygen into polluted rivers by artificial aeration was investigated. Optimal control of the aeration system in order to get the greatest improvement in water quality for the cost or energy expended, was emphasized. The optimal aeration policy was determined for a general river with multiple waste effluent sources, variable river cross section, and variable stream velocity. A stochastic river model was used to account for uncertainties and noise in the system. Various feedback structures were considered, and their performance was compared. An aeration controller was obtained which took into consideration the cost of making water quality measurements. (Small-FRC)
W79-07070

RESPONSE OF HALEY POND, MAINE, TO CHANGES IN EFFLUENT LOADS,
Maine Dept. of Environmental Protection, Augusta.
For primary bibliographic entry see Field 5D.
W79-07147

INHIBITION OF NITRIFICATION IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
L. G. Bundy, and J. M. Bremner.
Soil Science of America Proceedings, Vol. 37, No. 3, p 369-398, May-June 1973. 4 tab, 9 ref. OWRT A-041-IA(5).

Descriptors: *Nitrification, *Inhibitors, *Ammonium compounds, *Ureas, Nitrates, Nitrites, Chemical reactions, Soil types, Soil amendments, Clays, Clay loam, Water pollution sources, Water pollution abatement, Fertilizers, Agricultural chemicals, Groundwater, Water pollution.

The effectiveness of 24 compounds proposed as inhibitors of nitrification in soils was compared and the effects of temperature and form of nitrifiable N on inhibition of nitrification by these compounds was examined. Soils were treated with ammonium sulfate and incubated for 14 days at 30C to determine the effects of 10 ppm of each compound on the amounts nitrate and nitrite produced. With the three soils used the average effectiveness of the most potent inhibitors decreased. The results obtained with 14 inhibitors, two soil additives, and variations in incubation time and temperatures are tabulated. The results indicate that the effectiveness of the inhibitors was significantly affected by soil type, soil temperature and substitution of urea for ammonium sulfate as the source of nitrifiable N. Most inhibitors were more effective at 15C than at 30C. The results obtained with the 10 compounds studied, but not tabulated, show that none had a significant effect on nitrification under the conditions studied. (Davison-IPA)
W79-07171

EFFECTS OF SOIL PH AND MOISTURE ON THE DIRECT RADIOASSAY OF HERBICIDES IN SOIL,
Nebraska Univ., Lincoln. Dept. of Agronomy.
T. L. Lavy.
Weed Science, Vol. 23, Issue 1, p 49-52, January 1975. 4 tab, 12 ref. OWRT A-024-NEB(3).

Descriptors: *Herbicides, *Analytical techniques, *Assay, *Separation techniques, *Acidity, *Soil properties, Water pollution sources, Degradation(Decomposition), Chemical degradation, Clay loam, Water pollution, Groundwater.

The factors involved in the direct radioassay technique governing the extraction of 14C herbicides from soil were studied. A silty clay loam soil was ground to pass a 841 micron sieve and treated with the addition of 2,000 to 15,000 dpm of a 14C labeled herbicide in a methanol solution. Herbicide concentrations on soils ranged from 0.01 ppm to 2.0 ppm. When the methanol evaporated from the C-herbicide-soil slurry, the samples were thoroughly mixed. An addition of 1.5 ml water or 1.5 ml of 0.1 N oxalic acid solution to 2g soil samples containing 14C labeled herbicides increased the 14C extraction efficiencies. A modified dioxane extracting-counting solution was used which allowed the addition of 2 ml water without causing a liquid phase separation. Benzoic herbicide extraction from the soil was increased by the addition of 5 mg oxalic acid to 2g soil or when the soil was acidified to pH 4.1. (Davison-IPA)
W79-07172

FORMS OF METALS IN WATER,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
A. Demayo, A. R. Davis, and M. A. Forbes.
Scientific Series No. 87, 1978, 24 p, 1 fig, 94 ref.

Descriptors: *Metals, *Toxicity, *Biota, *Water quality, Water properties, Suspended solids.

This final report of a Water Quality Branch Headquarters Task Force reviews published scientific information on forms of metals in water and their toxicity to biota. It recommends the types of determinations that should be carried out by Water Quality Branch laboratories, the results of which are used in setting water quality objectives, in surveillance of compliance to water quality objectives, and in writing interpretive reports. For the purposes listed above, the Task Force suggests that the following be measured in all water samples: (1) dissolved (0.45 micro m) concentrations in water, (2) total concentrations in the suspended materials and the weight of the suspended materials per litre of water, and (3) total concentrations in the medium and fine fractions (less than 0.149 mm) of the bottom materials. (WATDOC)
W79-07202

INTERLABORATORY QUALITY CONTROL STUDY NO. 18 TOTAL MERCURY IN SEDIMENTS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
K. I. Aspila, and J. M. Carron.
Report Series No. 61, 1979, 19 p, 1 app, 3 fig, 3 ref, 6 tab.

Descriptors: *Lake sediments, *Mercury, *Laboratory tests, Analysis, Lake Superior, Lake Erie, Lake Ontario.

Results of an interlaboratory comparison study on the analysis of mercury in five lake bottom sediments are described. Twenty-eight Canadian laboratories participated. Concentrations of mercury in uncertified test samples ranged from 0.01 micro g per g to 0.6 micro g per g Hg. Mean values from participants were evaluated by rank correlation. Estimates of the concentration of mercury in each sample were determined by sequentially eliminating all data beyond two standard deviations of adjusted mean values. Precision functions identifying average in-laboratory and interlaboratory standard deviations as a function of mean calculated mercury content are described. These precision functions identify the anticipated comparability of mercury data when a variety of different laboratories analyzes the mercury content in processed dry sediments (less than 177 micro m) using different methods. (WATDOC)
W79-07205

HYDROCHEMICAL STUDY OF GROUNDWATER FLOW IN THE INTERSTREAM AREA BETWEEN THE OTTAWA AND ST. LAWRENCE RIVERS,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
J. E. Charron.
Scientific Series No. 76, 1978, in English and French, 28 p, 41 fig, 34 ref.

Descriptors: *Base flow, *Groundwater, *Hydrogeology, *Flow, *Bedrock, *Mapping, Geology, Climate, Infiltration, Data collections, Sampling, Water wells, Contours, Programs, Chemical analysis, Rivers, Streams, Elevation, *Hydrochemistry,

*Ottawa River, *St. Lawrence River, Contact zone.

The interstream area extending some 80 to 85 mi (130 to 140 km) upstream from the junction of the Ottawa and St. Lawrence rivers has been surveyed to determine the directions of groundwater flow. Hydrogeological and hydrochemical data have been compiled and are presented in the form of computer calculated contour maps at a scale of 1 to 250,000. An explanatory note accompanies each map describing the main features, trends, and discrepancies. Most of the maps are chemical maps and they form the basis on which a qualitative assessment of groundwater flow was made. The interpretations of both regional and local flows indicate that regionally very little groundwater flows towards the St. Lawrence River, proving that the bedrock configuration controls the direction of flow. (WATDOC)
W79-07221

LIMITATIONS OF SINGLE WATER SAMPLES IN REPRESENTING MEAN WATER QUALITY II SPATIAL AND TEMPORAL VARIATION IN NUTRIENT CONCENTRATIONS IN THE OKANAGAN RIVER AT OLIVER, B.C.,
Department of the Environment, Vancouver (British Columbia). Water Quality Branch.
P. H. Kleiber, P. H. Whitfield, and W. E. Erlebach.
Technical Bulletin No. 107, 1978. 30 p., 10 fig., 7 tab, 9 ref, 2 append.

Descriptors: *Water sampling, *Water quality, *Spatial distribution, *Temporal distribution, Variability, Nutrients, Phosphates, Nitrites, Organic compounds, Carbon, *Okanagan River, *British Columbia.

The Water Quality Branch, Pacific and Yukon Region, is investigating the spatial and temporal variation in water quality at selected monitoring stations in the region. This report concerns such as investigation at four stations located on the Okanagan River near Oliver, British Columbia. The objectives of the study are: (1) to determine representative values of water quality for the reach of river at which each station is located; (2) to ascribe confidence limits for the present values; (3) to estimate the confidence limits that can be applied to single grab samples collected at the station in the past; and (4) to determine the sampling effort necessary to detect year-to-year trends in water quality. (WATDOC)
W79-07222

PROCEEDINGS SLUDGE UTILIZATION AND DISPOSAL SEMINAR TORONTO, ONTARIO, FEBRUARY 20 AND 21, 1978,
Environmental Protection Service, Ottawa (Ontario). Water Training and Technology Transfer Div.; and Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
Canada-Ontario Agreement on Great Lakes Water Quality, Conference Proceedings No. 6, 428 p. 1978.

Descriptors: *Sludge disposal, *Waste water disposal, *Sludge treatment, Sampling, Viruses, Animal parasites, Metals, Lysimeters, Agricultural watersheds, Dewatering, Energy, Incineration, Aeration, Regulation, Costs, Analysis, *Waterloo, *Windsor, *Ontario, *Sludge thickening, Composting.

The Government of Canada and the Government of the Province of Ontario signed an agreement on August 13, 1971, to ensure that the water quality of the Great Lakes is restored and protected. One of the principal provisions of the Canada-Ontario Agreement was to provide for the acceleration of the construction of municipal sewage treatment projects for the abatement of pollution and to introduce phosphorus removal at all significant municipal sources. An additional important financial provision of the Agreement was for a research program directed towards reducing the cost of waste treatment and ensuring that the latest technological advances were incorporated to achieve the specific water quality objectives set out in the Agreement. A significant concern which was identified was the handling and disposal of sludges produced from the chemical treatment of sewage for phosphorus removal. Under the direction of the Sub-committee for the Land Disposal of Sludges, research projects have been conducted, both in-house and through external contracts, on sludge handling and disposal methods. Fifteen papers were presented, covering all facets of sludge handling from sampling methods and metal sources, through sludge conditioning and dewatering to incineration, composting and the regulatory aspects of sludge disposal. Sludge handling and disposal is the most difficult and most costly single aspect of wastewater treatment today. Up to 60 percent of the total cost of operating and maintaining municipal wastewater treatment plants is associated with sludge management. Cost-effective sludge disposal requires the examination of all process options. (WATDOC)
W79-07223

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07239

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07241

DREDGING AMERICA'S WATERWAYS AND HARBORS--MORE INFORMATION NEEDED ON ENVIRONMENTAL AND ECONOMIC ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07242

AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL UNDER SECTIONS 208 AND 303 OF THE CLEAN WATER ACT: HAS FORTY YEARS OF EXPERIENCE TAUGHT US ANYTHING,
For primary bibliographic entry see Field 6E.
W79-07248

ILLINOIS ENVIRONMENTAL LAW - STATE PRE-EMPTION OF LOCAL GOVERNMENTAL REGULATION OF POLLUTION RELATED ACTIVITIES,
For primary bibliographic entry see Field 6E.
W79-07263

HOW TO COPE WITH THE SAFE DRINKING ACT,
Texas Univ. at Austin. Lyndon B. Johnson School of Public Affairs.
For primary bibliographic entry see Field 6E.
W79-07264

STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION IN THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07265

NON-POINT POLLUTION AND ALASKA,
For primary bibliographic entry see Field 6E.
W79-07269

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

WATER COLUMN BACTERIOLOGY,
Texas Univ., San Antonio. Div. of Allied Health and Life Sciences.
For primary bibliographic entry see Field 5C.
W79-07295

INDUCED SPAWNING OF THE TWO PHYTOPHAGOUS CHINESE CARP SPECIES CTENOPHARYNGODON IDELLA (VAL.) AND HYPOPTHALMICHTHYS MOLITRIX (VAL.) WITH REFERENCE TO THE POSSIBLE USE OF THE GRASS CARP IN THE CONTROL OF AQUATIC WEEDS,
Randse Afrikaanse Univ., Johannesburg (South Africa). Navorsingsgroep vir Varswater-biologie.
H. J. Schoonbee, F. D. W. Brandt, and C. A. L. Bekker.
Water S. A., Vol. 4, No. 2, p 93-103, April 1978. 10 fig, 32 ref.

Descriptors: *Fish, *Carp, *Spawning, *Fish reproduction, *Fish eggs, *Fertility, Sexual maturity, Fish establishment, Aquatic environment, Fish diets, Fish food organisms, Eutrophication, Impounded waters, Rivers, Transvaal.

Because of serious eutrophication in several South African rivers and impoundments two Chinese phytophagous carp species, Ctenopharyngodon idella (Val.) and the silver carp, Hypothalmichthys molitrix (Val.) were imported. These species, known for their ability to utilize water weeds and phytoplankton as food, do not normally spawn outside their native range in the Amure River basin of mainland China and Russia. The fish are artificially spawned through the use of a combination of human chorionic gonadotrophin (HCG) and pituitary gland extract (PGE). Successful spawning of both species was produced by an initial injection of low dosage of HCG followed 24 hours later by a set of two main dosages, about seven hours apart; the first dose was HCG and the second, PGE. Within 24 hours of fertilization larvae of both species hatched. This induced spawning provided sufficient offspring for several research projects on evaluating the grass carp as a biological means to control certain noxious aquatic weeds in Transvaal impoundments. (Davison-IPA)
W79-07362

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA: 303(E) BASIN PLAN FOR THE RED RIVER OF THE NORTH RIVER BASIN,
South Dakota Dept. of Environmental Protection, Pierre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 085, Price codes: A07 in paper copy, A01 in microfiche. 1976, 125 p, 6 append, 11 tab, 2 fig.

Descriptors: *Water quality management(Applied), *River basins, *Regional planning, *Water quality, *Water quality standards, *Red River of the North River Basin(SD), *South Dakota, Water pollution control, Water pollution sources, Water quality control, Hydrology, Suspended solids, Dissolved oxygen, Typography, Soils, Effluents.

This report presents South Dakota's strategy for correcting water pollution and thereby improving and maintaining water quality in the South Dakota portion of the Red River of the North River Basin. The South Dakota portion of the Basin consists of the area drained by Lake Traverse and the Bois de Sioux River. This area drains 600 square miles, is a broad, level plain varying in width from 15 to 70 miles and slopes towards the north. It is expected that the Basin will continue to lose population

primarily due to migration from the farm to city. The economy is entirely dependent on agriculture. This plan specifies the process of planning and managing pollution abatement operations to achieve South Dakota's standards for pollution discharges to, and water quality in, Red River of the North River Basin's lakes, rivers and tributaries. General information pertaining to 303(e) plans, statutory authority for planning, an analysis of P.L. 92-500 (especially Section 303), and constitutional constraints to basin planning are offered. An in-depth basin profile is presented, including topography, hydrology, soils, surface water quality standards and classification of stream segments. Sources and effects of both point and non-point pollution are described through inventories of municipal, industrial and agricultural discharges with accompanying charts showing which streams are adversely affected by which type of pollution source. The appendices present water quality parameters, surface water quality standards, a summary of permit rationale, and a summary of public comments. (Coan-NC)
W79-07380

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA. 303(E) BASIN PLAN FOR THE CHEYENNE RIVER BASIN 08SD0700,
South Dakota Dept. of Environmental Protection, Pierre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 068, Price codes: A07 in paper copy, A01 in microfiche. 1974. 129 p, 5 append, 21 tab, 3 fig.

Descriptors: *Water quality management(Applied), *River basins, *Regional planning, *Water quality, *Water quality standards, *Cheyenne River Basin(SD), *South Dakota, Water pollution control, Water pollution sources, Best practicable treatment, Water quality control, Hydrology, Suspended solids, Dissolved oxygen, Typography, Soils, Effluents, Non-point source pollution.

This report presents South Dakota's strategy for correcting water pollution and thereby improving and maintaining water quality in the Cheyenne River Basin. This basin is roughly wedgeline in shape, and includes the northeastern corner of Wyoming, the southeastern corner of Montana, the southwestern corner of South Dakota, the northwestern corner of Nebraska, and the area through central South Dakota to the Missouri River. The sub-basin varies from 40 to 80 miles in width, drains an area of 12,955 square miles in South Dakota, and generally has excellent water quality, but there is evidence that water quality is declining. This plan specifies the process of planning and managing pollution abatement operations to achieve South Dakota's standards for pollution discharges to, and water quality in, Cheyenne River basin's lakes, rivers, and tributaries. General information pertaining to 303(e) plans, the statutory authority for planning, an analysis of Federal law P.L. 92-500 (especially Section 303), and constitutional constraints to basin planning are presented. An in-depth basin profile is presented, including topography, hydrology, soils, surface water quality standards, and classification of stream segments. Sources and effects of both point and non-point pollution are described through inventories of municipal, industrial and agricultural discharges with accompanying charts showing which streams are adversely affected by which type of pollution source. The appendices include a list of water quality surveys, surface water quality standards, a list of water quality monitoring stations, and summary tables for the 1974 Black Hills value survey. (Coan-NC)
W79-07382

FEASIBILITY OF A SYSTEMATIC APPROACH TO WATER QUALITY MANAGEMENT IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 561, Price codes: A07 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality, Chicago Report No. 77/35, October 1977. 139 p. 20.083.

Descriptors: *Water quality management(Applied), *Water quality, *Water use, *Water quality control, *Water pollution, *Illinois, Water pollution control, Water pollution sources, Recreation, Withdrawal, Environmental quality, Water quality standards, Effluent standards, Non-point pollution, Stream/lake classification system.

This is an investigation of the feasibility of developing a more systematic water quality management scheme for the State of Illinois. This management scheme would: (1) determine actual and potential stream uses; (2) determine stream standards and water quality criteria required to meet those uses; (3) evaluate the current water quality record to determine where the uses are not being supported by adequate water quality; (4) assess amount of water quality improvement necessary; (5) define principal contributors to water quality; (6) determine upgrading methods to be applied, their effectiveness and costs. The report describes the theory and rationale behind the water quality management concept. The feasibility of identifying water uses and related standards are described; as well as the feasibility of using historical water quality records in support of the stream/lake classification system and the feasibility of determining methods, costs, and effectiveness of upgrading strategies. The principal thrust of the research is to reorganize existing water quality data in order to shed new light on the state's water quality problems and on opportunities for improvement. The report discusses the present ability to predict the impacts of controlling agricultural sediment, nutrient and chemical contamination of surface waters. Non-point pollution from mining and construction sites is evaluated. A case study of three basins is presented, and needed research and future directions discussed. (Coan-NC)
W79-07384

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 5. GENERAL GEOLOGY AND SEISMICITY,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 2F.
W79-07386

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 2: WATER-QUALITY, METEOROLOGIC AND HYDROLOGIC DATA COLLECTED WITH AUTOMATED FIELD STATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
H. W. West, and H. M. Floyd.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 827, Price codes: A04 in paper copy, A01 in microfiche. Technical Report M-77-4, September 1977, 74 p, 9 tab, 1 appendix. 4A162121A896.

Descriptors: *Water quality, *Natural resources, *Hydrologic data, *Meteorologic data, *Fort Carson(CO), Instrumentation, Measurement, Hydrology, Water resources, Wildlife, Wind Velocity, Environmental data, Environmental management, Military installations.

This report is second in a series of six reports describing methodologies and procedures to collect environmental baseline data that are pertinent to the Fort Carson, Colorado Long-Range Environmental Program. The U.S. Army Engineer Waterways Experiment Station (WES) was instructed to acquire water-quality, meteorologic, and hydrologic data to assist in determining the characteristics of the surface waters that exist on or pass through the installation and to provide quantitative data to support the installation's natural resource management programs. The report describes what the water quality, meteorologic, and hydrologic parameters were, the rationale for selecting the parameters, and the methods and frequency of the measurements. Tables show sites selected for the various measurements, the dates for the data collection period, and the results for the various measurements. Preliminary analyses were made of some of the data collected on water quality, meteorologic, and hydrologic conditions, and comparisons were made with the state of Colorado water-quality standards and surrounding meteorologic conditions as observed at nearby weather stations. All sensors used by WES at Fort Carson for environmetal data collection, together with appropriate mathematical conversions of the raw field data into engineering units, are described in the appendices. These data include rainfall measurement, solar radiation, air temperature, wind speed, wind direction, water quality sensors, and water conductivity. (Coan-NC)
W79-07387

WATER DISTILLER,
J. D. Kirschmann.
U.S. Patent No. 4,135,984, 11 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1376, January 23, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Demineralization, Separation techniques, Distillation, Condensation, Equipment.

A bottom boiler unit and a top condensing unit are utilized to provide distilled water at a desired temperature level. The condensing unit comprises a vessel in which supply water is maintained at a predetermined level in heat exchange relation with steam passing through a circuitous, tubular passage from the boiler, with the result that the steam is cooled and condensed to distilled water which is directed outward from the unit through a fluid outlet. Steam rising from the bottom boiler unit is directed to the top of the circuitous tubular passage in the condensing unit so that condensing and cooled vapors flow downward in the circuitous flow passage toward the fluid outlet for distilled water and a temperature gradient is maintained in the supply water contained in the condensing vessel. The cool supply water is located at the bottom of the condensing vessel, and preheated supply water at a higher temperature will be at the top of the condensing vessel for introduction into the flow tube extending downward into the boiler vessel. An adjustable thermostat in the condensing unit regulates the flow of supply water in response to the temperature of outgoing distilled water. A mineral water discharge passage is provided in the lower portion of the boiler vessel. The discharge passage is sized and shaped to provide a predetermined restriction to the outflow of residue water which prevents the accumulation of minerals and other impurities. (Sinha-OEIS)
W79-07399

AEROSOL DISPERSION OF MICROORGANISMS TO ELIMINATE OIL SLICKS,
K. Bisa, and T. Bisa.
U.S. Patent No. 4,136,024, 13 p, 6 fig, 12 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1389, January 23, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water pollution treatment, Microorganisms, Microbial degradation, Water quality control, Aerosols, Dispersion, Hydrocarbons.

A method for the elimination of contamination caused by hydrocarbons on water surfaces, such as the ocean and other surface waters is described. Microorganisms, in particular bacteria, capable of degrading hydrocarbons are released into the atmosphere, together with suitable culture media, at a predetermined height above the contaminated area, in the form of aerosols in clouds that are heavier than air so that they gradually settle by gravity onto the contaminated surface. Discharging the microorganisms together with culture

media in a fine dispersion is advantageous as the microorganisms form a finely dispersed aggregation with the particles of the culture medium, and thus are able to remain for longer periods of time in the air. A several-fold increase in bacteria growth is thus accomplished before the microorganisms deposit on the hydrocarbons. This shift in effective concentration ratios in favor of the microorganisms makes it possible to adequately eliminate contaminating hydrocarbons even in relatively large areas. (Sinha-OEIS)
W79-07404

METHOD FOR TREATING WATER,
Osaka Gas Co. Ltd., (Japan). (Assignee).
For primary bibliographic entry see Field 5F.
W79-07405

APPARATUS FOR COLLECTING EFFLUENT OIL,
Mitsubishi Jukogyo Kabushiki Kaisha, Tokyo (Japan). (Assignee).
Y. Seike, Y. Matsuo, M. Nakashima, T. Shojima, and S. Masaaki.
U.S. Patent No. 4,136,030, 17 p, 14 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1391, January 23, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water pollution treatment, *Water quality control, Boats, Weirs, Separation techniques, Equipment, Oil recovery.

Improvements are made in the known apparatus for collecting effluent oil. The apparatus includes a pair of left and right side plates, a weir plate mounted to the side plates inclined in a rear-downward direction under a water surface, a slant plate with its rear end positioned above the rear end of the weir plate, and an oil leakage preventing plate positioned in the midway between the rear end of the weir and the rear end of the slant plate to form a water discharge port and to form an oily water intake port. The improvements are that only an oily water layer in the vicinity of a water surface can pass into the oil pool beyond the top edge of the weir and slant plate, and an oil leakage preventing plate. A pair of wave buffer chambers of cylindrical shape absorb and attenuate kinetic energy possessed by the wave of the oil and water flowing into the oil pool. (Sinha-OEIS)
W79-07406

LIQUID TREATMENT APPARATUS,
D. A. Bakken, R. A. Henderson, and E. J. Tischler.
U.S. Patent No. 4,136,032, 10 p, 30 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 4, p 1391-1392, January 23, 1979.

Descriptors: *Patents, *Water softening, *Water treatment, *Flow control, Automatic control, Valves, Equipment, Water quality, Regeneration.

Water softening apparatus using ion exchange resin particles must be regularly regenerated with brine in order to restore or maintain the water hardness removing capacity of the resin particles. The flow control valve for such apparatus must accurately control the volume and velocity of liquid flowing through the particles and the brining system during four or more cycles. The apparatus has to be capable of operating under a wide range of pressure, flow, and hardness conditions. A flow control valve for multicycle liquid treatment apparatus has a pair of rotatable, slotted circular discs at its opposite ends. Rotation of the discs causes the slots to be selectively aligned with various ports, passages, holes and channels so as to control the direction and duration of liquid flow during the different cycles of the apparatus. (Sinha-OEIS)
W79-07407

FERTILIZERS AND PESTICIDES IN RUNOFF AND SEDIMENT FROM CLAYPAN SOIL,
Missouri Water Resources Research Center, Columbia.
G. E. Smith, R. Blanchar, and R. E. Burwell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 181, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, May 1, 1979. 67 p, 7 fig, 14 tab, 15 ref, 1 append. OWRT B-099-MO(1).

Descriptors: *Fertilizers, *Pesticides, *Runoff, *Sedimentation rates, *Nitrogen, *Phosphate, Crop response, Crop production, Corn, Soybeans, Soil treatment, Soil types, Agriculture, Cultivated land, Erosion, Cultivation, Land management.

Instrumented field plots were used to determine losses of nitrogen, phosphates and some pesticides from runoff in corn and soybean production over a period of seven years. The losses were related to the amounts of these elements applied as fertilizers, and where the applications were in excess of crop needs the losses were substantial. Runoff and sediment losses of these nutrients were higher where fertilizer additions were insufficient for vigorous crop growth, than where optimum amounts of fertilizer were used. Nitrogen losses in runoff water were about 8% of the applied optimum amount of ammonium nitrate, and the nitrogen in precipitation for some storm events was greater than in runoff. The nitrogen lost on an annual basis was greater than that added from the atmosphere. Phosphorous fertilizer applications in excess of the amount needed increased the total phosphate in runoff; phosphate in runoff was less where plots received optimum nitrogen treatments. Where good crop and soil management controlled erosion the amount of available phosphate absorbed on sediment and lost in suspended material was small. Herbicide and insecticide losses in runoff were associated with storm events occurring soon after application; small quantities were lost in later runoff events. Soil fertilization promoting early, vigorous crop growth resulted in less loss of the nutrients and reduced sediment loss. (Davison-IPA)
W79-07422

CONTROLLED RECHARGE OF WASTE WATER FOR AQUIFER PROTECTION AND PRODUCTION OF RENOVATED WATER,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
H. Bouwer, R. C. Rice, J. C. Lance, and R. G. Gilbert.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 441-447, 1977. 1 fig, 18 ref.

Descriptors: *Waste water(Pollution), *Aquifers, *Protection, *Recharge, *Groundwater, Infiltration, Nitrogen, Phosphorus, Organic carbon, Pathogens, Renovated water, Reuse, Costs, Water quality.

Groundwater recharge with controlled infiltration of waste water and extraction of renovated water can be an effective technique for renovating municipal and other waste water, while minimizing contamination of native groundwater. Infiltration is accomplished with basins or other facilities. Application and resting periods and infiltration rates are selected to yield the optimum combination of quantity and quality of renovated water. Wells or drains for collecting the renovated water are located far enough away from the infiltration system to provide sufficient time and distance of underground travel in relation to the intended use of the renovated water. Well-designed and well-operated systems should be capable of producing renovated water free from pathogens and with greatly reduced nitrogen and phosphorus concentrations. The water can be re-used for unrestricted irrigation, recreation, and industrial purposes. Potable use of water should be discouraged, unless refractory organics are removed or proven harmless. (See also W79-07426) (Bell Graf-Cornell)
W79-07474

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

HYDROLOGIC MODELING AND DATA REQUIREMENTS FOR ANALYSIS OF URBAN STREAMFLOW MANAGEMENT ALTERNATIVES,
Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
G. J. Kemp, and S. J. Burges.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 499, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No. 57, November 1978. 130 p, 6 fig, 8 tab, 103 ref, 1 append. OWRT A-092 WASH(1). 14-34-0001-8051.

Descriptors: *Model studies, *Hydrologic systems, *Water resources development, *Planning, *Urban hydrology, *Watershed management, Runoff, Rainfall, Forecasting, Streamflow, Streamflow forecasting, Hydrology, Hydrographs, King County, Snohomish County(Washington), Stanford Watershed Model.

Continuous simulation hydrologic modeling is one approach to the incorporation of empirical knowledge of watershed dynamics into planning at the land development and total watershed levels for analyzing urban runoff strategies. In developing the use of this type of model for King and Snohomish Counties, Washington, personal interviews were used to identify the modeling needs and desires of potential model users and their perceptions of models. The literature was reviewed for professional modelers perceptions which were compared with those of the potential users. The development of evaluative criteria for local use of continuous simulation models is presented. From the examination of the general characteristics of several continuous simulation models it was found that variations of the Stanford University Model (SWM) were the only models possessing the desired characteristics. These are evaluated in detail as a group. It is concluded that the SWM provides better information than more commonly used methods. The Hydrocomp Simulation Processor II is recommended for implementation as the model best suited for this specific location. Its primary limitation is its demand for data, particularly rainfall records, and the associated cost of data development and handling. (Davison-IPA)
W79-07004

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
For primary bibliographic entry see Field 6B.
W79-07063

MULTIPLE OBJECTIVES UNDER UNCERTAINTY: AN ILLUSTRATIVE APPLICATION OF PROTRADE,
Oklahoma State Univ., Stillwater.
A. Goicoechea, L. Duckstein, and M. M. Fogel.
Water Resources Research, Vol. 15, No. 2, p 203-210, April 1979. 2 fig, 4 tab, 38 ref. OWRT B-043-ARIZ(30), B-055-ARIZ(2).

Descriptors: *Decision making, *Methodology, *Optimization, *Tradeoff development, *Risk, *Protrade method, Water resources, Land use, Benefits, Constraints, Strip mining, Coal, Mine spoils, Systems analysis, Mathematical models, Equations, Crops, Runoff, Fish yield, Sediments, Livestock, System design, Long-term planning, Simulation analysis, Minimization, Maximization, Linear objective functions, Economics.

A decision making method labeled Protrade has been developed to account for both multiple objectives and uncertainty aspects. This method is applied to the case study of the Black Mesa Region in Northern Arizona which is being strip mined for coal. One important concern in large-scale surface

mining is the reclamation of mine spoils to bring about beneficial land uses while observing economic, social, environmental, and legal constraints. Protrade considers a set of linear objective functions with random parameters, subject to a set of physical constraints; the preferences of the decision maker are articulated in a progressive manner, and alternative solutions are generated. Nonlinear deterministic equivalents are introduced to account for uncertainty in some of the parameters involved. While no final policy recommendations are made, this illustration of Protrade is carried out to investigate the potential of the method for trading off multiple objectives and measures of uncertainty in water and other natural resource system design problems. (Bell Graf-Cornell)
W79-07100

IMPROVEMENTS NEEDED BY THE WATER RESOURCES COUNCIL AND RIVER BASIN COMMISSIONS TO ACHIEVE THE OBJECTIVES OF THE WATER RESOURCES PLANNING ACT OF 1965,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07233

AN ECONOMIC FEASIBILITY STUDY OF IRRIGATED CROP PRODUCTION IN THE PECOS VALLEY OF TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 3F.
W79-07253

INLAND BOUNDARY DETERMINATIONS FOR COASTAL MANAGEMENT PURPOSES - AN ECOLOGICAL SYSTEMS APPROACH TO REQUIREMENTS OF THE FEDERAL COASTAL ZONE MANAGEMENT ACT OF 1972,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6E.
W79-07270

THE PUBLIC TRUST DOCTRINE IN NORTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07271

AN ALTERNATIVE PERSPECTIVE ON COMMON PROPERTY RESOURCE ALLOCATION DECISIONS IN THE COASTAL ZONE,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 6E.
W79-07274

COASTAL LAND MANAGEMENT: AN INTRODUCTION,
Bates Coll. of Law, Houston, TX.
For primary bibliographic entry see Field 6E.
W79-07277

CONSERVATION AND DEVELOPMENT IN OREGON'S COASTAL ZONE,
For primary bibliographic entry see Field 6E.
W79-07280

SIMULATION OF THE URBAN RUNOFF PROCESS,
Snowy Mountains Engineering Corp., Canberra (Australia).
D. C. Black, and A. P. Aitken.
Australian Water Resources Council, Canberra, Department of National Resources, Technical Paper No. 26, 1977. 120 p, 7 append, 14 fig, 9 tab.

Descriptors: *Hydrologic models, *Simulation, *Models, *Water resource planning, *Stage-discharge relations, *Australia, *Canberra, *Melbourne, *Urban catchment models, Hydrographs, Flood peaks, Urban runoff, Flood forecasting, Urban hydrology, Rainfall-runoff relationships, Infiltration, Hydrologic data, Data processing, Catchment basins.

This report describes the application of the Australian Representative Basins Model (ARBM) and Hydrocomp Simulation Programming (HSP) to two urban catchments in Australia, one in Canberra and one in Melbourne. Part A of the paper describes the details of the investigations and recommends the further use of ARBM in Australian cities. Included in part A is a general discussion of urban catchment models, their definitions, classification, types and data requirements. Summary statistics on flood peaks, daily runoffs and monthly runoffs are presented, with explanations for the differences between observed and predicted values. A description of the ARBM and HSP models is presented and their differences are illustrated by flow diagrams, diagrammatic sketches, and listed subroutines. Part B describes the origins and features of the ARBM model. The model is designed to simulate the behavior of the land phase of the hydrological cycle for small catchments. The model consists of four main sections: (1) the catchment water balance procedure; (2) the runoff routing method; (3) the statistical tests comparing estimated and observed runoffs; and (4) the plotting of hydrographs. Flow charts, variables, data input streams, output details, and program listings are used to examine features of the model and are listed in appendices. The most important conclusion of the report is that simulation of the rainfall-runoff process for urban catchments is useful in Australia but is an expensive tool to use. (Coan-NC)
W79-07376

SIMULATION VERSUS A PROBABALISTIC APPROACH FOR EVALUATING STORM-WATER TREATMENT ALTERNATIVES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W79-07423

EFFECTS OF URBANIZATION AND INDUSTRIALIZATION ON THE HYDROLOGICAL REGIME AND ON WATER QUALITY.
Proceedings of the Amsterdam Symposium, October 1977, convened by UNESCO and organized by UNESCO and the Netherlands National Committee for IHP in cooperation with IAHS. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, 1977. 572 p.

Descriptors: *Effects, *Urbanization, *Industrialization, *Hydrologic regime, *Water quality, *Water policy, Urban hydrology, Design, Management, Planning, Hydrologic cycle, Atmospheric aspects, Surface waters, Groundwater, Water supply, Methodology, Water conservation, Water pollution, Water reuse, Optimization, Simulation analysis, Equations, Analytical techniques, Mathematical models, Systems analysis.

This conference was organized by UNESCO and the Netherlands National Committee for the International Hydrological Programme (IHP) in cooperation with IAHS. The 63 papers submitted for the plenary sessions of the Symposium are contained in this volume and refer to the following themes: (1) the effects of urbanization and industrialization on the hydrological regime; (2) the effects of urbanization and industrialization on water quality; and (3) water policy as a factor in urbanization and industrialization. Dealt with are: effects on the atmospheric part of the hydrological cycle; effects on surface and ground water; water supply and methodology for water conservation; pollution of surface and ground water; water reuse; and measures to be taken for optimizing reuse. The authors demonstrate a serious involvement with urban hydrology as a distinct branch of the broad field of hydrology. The hydrological effects of urbanization and industrialization need still more attention from scientists and from those responsible for design and management of water systems. (See W79-07427 thru W79-07488) (Bell Graf-Cornell)
W79-07426

MATHEMATICAL MODEL SYSTEM FOR CONTINUOUS OPERATIONAL CONTROL OF RIVER FLOW AND SALT CONCENTRATION IN AN INDUSTRIALIZED RIVER BASIN,
Institut fuer Wasserwirtschaft, Berlin (German, D.R.).
A. Becker, and P. Sosnowski.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 191-198, 1977. 3 fig, 13 ref.

Descriptors: *Model studies, *Simulation analysis, *Real-time control, *River flow, *Salt concentration, *Reservoirs, *Forecasting, *Computer programs, *Operating rules, River basins, Industries, Water supply, Methodology, Flood control, Data transmission, Waste water storage, Long-term planning, Short-term planning, Equations, Operations research.

To guarantee the water supply for a system of big industrial consumers and other consumers in the Saale River basin as well as flood control, the continuous control of river flow and salt concentration of the main rivers is necessary. This control is normally on a daily basis, but under critical conditions it is based on 12 h or 6 h intervals. For this purpose a comprehensive simulation planning model system and data transmission system have been developed which make it possible to: (1) forecast the river flow and salt concentration of the main rivers continuously; and (2) calculate the optimum real-time control of the existing reservoirs and of a salt waste water storage system. The function and the general structure of the mathematical modeling system are described. (See also W79-07426) (Bell Graf-Cornell)
W79-07447

THE IMPACT OF SEWER SYSTEM OVERFLOWS ON RECEIVING WATERS AS DEFINED BY MATHEMATICAL MODELLING,
Dorsch Consult, Munich (Germany), F.R.).
W. F. Geiger.
In: Effects of Urbanization and Industrialization on the Hydrological Remime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 303-310, 1977. 3 fig, 1 tab, 5 ref.

Descriptors: *Water pollution, *Overflow, *Computer models, *Simulation analysis, *Effects, Storm runoff, Assessment, Decision making, Precipitation, Statistical methods, Receiving waters, Sewer systems, Systems analysis, Urban runoff, Hydrology, Water quality.

Storm runoff causes the same magnitude of pollution loads entering receiving waters as secondary treatment effluent. The impact of these loadings is intermittent and cannot be defined with reasonable costs by measurements only. Computerized mathematical simulation models have been recognized as aids to the assessment of pollution loads and decision making in selection of overflow abatement alternatives. But, as the processes involved in urban runoff have statistically those properties of random events, it follows that meaningful and realistic conclusions on urban runoff and its pollution can only be derived from the investigation of long precipitation records. For a simulation model, sufficient detail is necessary to represent the rapidly varying runoff processes. In addition to monthly and yearly totals, statistical analyses of continuous simulation results provide frequencies and durations of overflows and overflowing pollution loads. These results assess the impact of sewer system overflows on receiving waters. Predicting the impact of future conditions, a technical basis for cost-benefit considerations is provided supporting storm water management decisions. (See also W79-07426) (Bell Graf-Cornell)
W79-07458

THE STRUCTURE OF THE DECISION-MAKING PROCESS WITHIN THE WATER RESOURCES MANAGEMENT SYSTEM,
Provinciale Waterstaat van Gelderland, Arnhem

(Netherlands).
Th. J. van de Nes.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 529-542, 1977. 6 fig, 3 ref.

Descriptors: *Water policy, *Decision making, *Water resources, *Management systems, *Hierarchical analysis, Mathematical models, Systems analysis, Water supply, Water management(Applied), Water distribution(Policy), Water purification, Planning, Gelderland(Netherlands), Surface waters, Groundwater.

The instruction to the Committee for the Study of Water Resources Management in Gelderland runs as follows: 'creation of a scientific base for an optimal management of the surface and ground waters available in Gelderland with regard to their quantity and quality'. A first attempt has been made to analyze the water resources management system as a whole on a regional scale. The large-scale and complex character of the system necessitates the involvement of many disciplines in the study. On the one hand, this causes problems of communication between the various disciplines and on the other hand, problems of transfer of knowledge to management. Solving these problems with the aid of the theory concerning hierarchical systems has been tried. This approach enables the dissolution of the complex system into a number of subsystems without losing sight of their mutual dependence. In this approach, the water resources management system is divided into a number of levels that are studied with the aid of mathematical models. Thus, the complex decision process is divided over various levels, so that it can be solved more efficiently. The way in which the results can be used in the planning of water resources management gives an insight into the structure of the decision process. (See also W79-07426) (Bell Graf-Cornell)
W79-07484

IMPACT OF URBANIZATION ON REGIONAL AND NATIONAL WATER PLANNING AND MANAGEMENT,
Hydrologic Engineering Center, Davis, CA.
E. A. Stallings.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 543-549, 1977.

Descriptors: *Effects, *Urbanization, *Alternative planning, *Water management(Applied), Regional development, National, Water plans, Mathematical models, Projects, Evaluation, Impact assessment, Measurement, STORM model, Systems analysis.

There are four major steps in the development of a regional water plan and the corresponding effects due to urbanization. The first two steps are problem identification and formulation of alternatives with the corresponding development of problem solutions. The next step in the planning process involves the impact assessment which introduces the mathematical modeling process. The final phase is evaluation which will discuss the effects both with and without the project. Finally, a description of the important trade-off analysis in the planning process and the relationships as effected by urbanization is given with examples from actual on-going projects. (See also W79-07426) (Bell Graf-Cornell)
W79-07485

QUASI-SYSTEMS APPROACH TO WATER QUALITY PLANNING FOR URBAN BASINS: A MODEL FOR POLICY EVALUATION,
Virginia State Water Control Board, Richmond. Piedmont Regional Office.
P. Das.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 565-572, 1977. 2 fig, 10 ref.

Descriptors: *Long-term planning, *Water pollution control, *Optimization, *Simulation analysis, *Economic impact, *Environmental effects, *Cost minimization, Management, Surface waters, Basins, Urbanization, Water quality, Mathematical models, Systems analysis, Capacity expansion, Waste water(Pollution), Sewage treatment, Treatment facilities, Municipal wastes, Industrial wastes, Standards, Pollutants, Evaluation, Point source pollution, Module approach.

A systematic methodological approach to the long-term planning and management for surface water pollution control in a small basin undergoing urbanization is presented. A number of water quality components including biological oxygen demand, total phosphorus and total suspended solids attributed jointly to municipal and industrial point sources and through urban storm water runoff are considered. The mathematical models developed include: (1) a parametric simulation model to study the urban storm water runoff pollution problem; and (2) an optimization model for least-cost capacity expansion and operational planning for point source waste water and storm water sewage treatment plants. The outputs from the simulation model constitute the inputs to the optimization model. Since the urban runoff pollution problem is truly a large-scale and complex system, a module approach is utilized for simulation. The modules are grouped into two submodels, one containing storm water quantity modules and the other containing quality modules. The optimal levels of pollutants removed in the municipal and industrial waste water and storm water sewage treatments plants are then determined for a parametric set of storm quality standards related to each pollutant. (See also W79-07426) (Bell Graf-Cornell)
W79-07488

6B. Evaluation Process

HYDRO POWER: ECONOMIC COMPARISONS,
MITRE Corp., Bedford, MA.
P. R. Vance, and L. C. Bryan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 694, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. MTR-3394, December 30, 1976. 33 p, 9 fig, 1 tab, 6 ref, 1 append. 367A. CG-00007.

Descriptors: *Electric power costs, *Electric power plants, *Hydroelectric plants, Economic prediction, Costs, Cost comparisons, Capital costs, Operating costs, Maintenance costs, Fuel costs, Fuels, Fossil fuels, Coals, Oil, Nuclear power-plants, Cost analysis, Equations.

Production cost equations for hydro generation and for fossil-fired alternatives are developed. The inflation of fuel, capital, and labor costs were taken into account in determining the generation cost of power produced by these types of plants. A cost comparison is made of the 15 year period prior to the oil embargo of October 1973 and the first 15 years of operation of the plants currently in planning. The results show that the economic competitive position of hydroelectric generation has greatly improved because of the escalation of fuel costs. It is concluded that many potential hydro projects, formerly uneconomic, may now be considered economically sound. (Davison-IPA)
W79-07007

REPORT OF WASTE SOURCE INVENTORY AND EVALUATION, DADE COUNTY, FLORIDA, TECHNICAL APPENDIX II, MINOR MUNICIPAL WASTEWATER TREATMENT FACILITIES,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5D.
W79-07029

GUIDANCE FOR SEWER SYSTEM EVALUATION,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 451, Price codes: A02 in paper copy, A01 in microfiche. Report EPA/520/9-74/018, 1974. 10 p, 1 fig, 1 append.

Descriptors: *Evaluation, *Sewerage, *Infiltration, *Rehabilitation, *Inflow, *Rehabilitation, Inspection, Design, Municipal wastes, Industrial wastes, Waste water treatment, Performance, Surveys, Cleaning.

Guidance is provided to engineers, municipalities, and regulatory agencies on sewer system evaluation of infiltration/inflow. Infiltration occurs when existing sewer lines undergo material and joint degradation and deterioration as well as when new sewer lines are improperly designed and constructed. Inflow occurs when rainfall enters the system through direct connections. Both reduce the capability of municipal and industrial systems to transport and treat waste water. Evaluation methods are described including physical survey, rainfall simulation, preparatory cleaning, internal inspection, and survey report. The final phase of the evaluation results in a survey report of data gathered during the survey and a justification for each sewer section cleaned and inspected. A rehabilitation program to eliminate all defined excessive infiltration/inflow is also part of the final phase. (Small-FRC)
W79-07035

ECOLOGICAL ASSESSMENTS FOR WASTEWATER MANAGEMENT IN SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5C.
W79-07041

OPERATIONAL CONTROL PROCEDURES FOR THE ACTIVATED SLUDGE PROCESS. PART III-B. CALCULATION PROCEDURES FOR STEP-FEED PROCESS RESPONSES,
National Field Investigations Center-Cincinnati, OH.
For primary bibliographic entry see Field 5D.
W79-07058

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 372, Price codes: A06 in paper copy, A01 in microfiche. Report, 1974. 108 p, 10 fig, 27 tab.

Descriptors: *Cost analysis, *Cost comparisons, *Sewerage, *Interceptor sewers, *Economics, Project planning, Sewers, Routing, Waste water treatment, Municipal wastes.

Methodologies and demonstrations of three cost-effectiveness studies of sanitary sewerage systems are presented. The first study is a cost comparison associated with eliminating extraneous flow problems in existing sanitary sewer systems. Six alternate solutions are demonstrated and the estimated project cost and present worth of each alternate system are calculated. The second study presents a cost comparison associated with selecting interceptor sewer routes. Two alternate plans are compared for estimated project costs and present worth. The third study compares the costs associated with waste water treatment for outlying communities in metropolitan areas. Four alternate plans are developed and compared for estimated project costs and present worth. (Lisk-FRC)
W79-07063

ECONOMIC VALUE OF BENEFITS FROM RECREATION AT HIGH MOUNTAIN RESERVOIRS,
Colorado State Univ., Fort Collins. Water Resources Research Inst.
R. G. Walsh, R. Aukerman, and D. Rud.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 636, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No. 14, December 1978. 18 p, 1 fig, 8 tab. OWRT A-036-COLO(1). 14-34-0001-8006.

Descriptors: *Recreation demand, Economics, Water demand, Recreation facilities, *Reservoirs, Public lands, Instream flow.

This study developed and applied a procedure for measuring recreation benefits of high mountain reservoirs. Two hundred people were interviewed at 12 high mountain reservoir sites on the Front Range of Colorado during the summer of 1978. The 12 study sites represented the range in size from 10 to 400 acres and other characteristics such as road or trail access and facilities, typical of reservoirs located at 6,000 to 11,000 feet elevation along the Front Range of Colorado. For comparison, 40 boaters were interviewed at two reservoirs located in the foothills of the Front Range at 5,000 to 6,000 feet elevation. Each recreation participant was asked for an estimate of his or her direct out-of-pocket costs in making the trip. Direct costs associated with the activities were identified easily. This was followed by a surplus value question, which asked respondents to consider the maximum worth of their recreation experience, defined as the increase in total trip expenses above which they would decide not to participate, given water level and crowding level as they existed on the day of the interview. Respondents were then asked to estimate how their participation and value would change with changes in the current water level to five threshold levels: 100, 75, 50, 25 and zero percent of maximum bankful. Thus, respondents were asked to consider each of these water levels as unique recreation resources, with the expectation that each would have a distinct demand.
W79-07128

THE OKAVANGO DELTA: PLANNING FOR THE FUTURE,
Zululand Univ., Empangeni (South Africa). Dept. of Botany.
P. Reavell.
South African Journal of Science, Vol. 74, No. 5, p 165-167, May 1978. 1 fig.

Descriptors: *Planning, *Natural resources, *Water resources, *Water resources development, *Okavango Delta(Botswana), Fisheries, Water utilization, Conservation, Environmental effects, Industrial water, Animal diseases.

A symposium from August 30 to September 2, 1976 on the future management of the Okavango Delta at Gaborone, Botswana, is reviewed. The topics covered included: wildlife; tourism; game and trophy hunting; the possibility of combining cattle farming with game ranging; cattle husbandry; the eradication of such diseases as nagana and foot-and-mouth; aquatic resources; a fishing industry; water for industry; possible engineering changes to the hydrological regime; and exporting water to bordering countries. Specific changes likely to occur in the delta regardless of man's intervention are examined. (Davison-IPA)
W79-07176

METHANE FROM GEOPRESSURED AQUIFERS STUDIED,
University of Southern California, Los Angeles.
T. M. Doscher, R. H. Osborne, S. W. Rhee, T. Wilson, and D. Cox.
The Oil and Gas Journal, Vol. 77, No. 15, p 178-183, April 9, 1979. 4 fig, 1 tab, 5 ref.

Descriptors: *Methane, *Geopressured aquifers, *Economic feasibility, *Brine disposal, Brines, Productivity, Cost analysis.

The economics of producing methane from geopressured brines beneath the south Texas Gulf Coast are examined. The economic limit for production from such reservoirs was assumed to be reached when bottom hole pressure fell to that corresponding to a hydrostatic head to the surface. It was necessary to assign probable values to the reservoir parameters in order to solve the pseudo-steady-state flow equations for an average sustained production rate over a predetermined lifetime. Two parameters that could not be well defined are the compressibility and the size and configuration of the reservoir. The overall results of the cost calculations indicate that the cost of methane recovered from geopressured aquifers could be reduced to $4/Mscf only if reservoir volumes were in excess of 1 cu. mile and the optimistic estimates of operating costs prevailed. For the more likely reservoir volumes, the costs would be in excess of $10/Mscf. It does not appear likely that methane recovered from geopressured aquifers can be a competitive supply of energy in the United States for many generations to come. (Purdin-NWWA)
W79-07193

CONCEPTS OF VALUE FOR WATER-BASED RECREATION OPPORTUNITIES,
Illinois Univ. at Urbana-Champaign. Agricultural Experiment Station.
J. F. Dwyer, and M. D. Bowes.
Water International, p 11-15, September 1978. 1 fig, 15 ref. OWRT C-7525 (No. 6237) (2).

Descriptors: *Cost-benefit analysis, *Recreation demand, Economics, Recreation planning, Value, Planning, Resource allocation, Model studies.

Willingness-to-pay is the appropriate concept for fee-setting when new recreation sites are created by an alternative plan, and willingness-to-sell (WTS) rights to those opportunities (or the minimum compensation required to bid land and water resources away from present uses) is the appropriate valuation concept for lost recreation output when an alternative plan destroys recreation opportunities or makes them unavailable in some other way. For privately owned resources the latter is often best reflected by the selling price of the land and related resources, while for public resources the minimum compensation required by present users of the area is the appropriate valuation concept. At present there is no generally satisfactory method for accurately evaluating WTS. The correct use of benefit-cost analysis is to compare generated gross benefits of a project (measured as total WTP) to the cost of bidding necessary resources away from alternative uses (WTS). WTP may be estimated by the area under the demand curve for the site in question. For lost net benefits from destroyed resources the area under the demand curve above cost is at best lower bound. While much effort has been devoted to modelling WTP for recreation opportunities, little has been directed toward WTS, or to explain wide differences between survey estimates of WTP and WTS. (Lynch-Wisconsin)
W79-07227

IMPROVEMENTS NEEDED BY THE WATER RESOURCES COUNCIL AND RIVER BASIN COMMISSIONS TO ACHIEVE THE OBJECTIVES OF THE WATER RESOURCES PLANNING ACT OF 1965,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07233

DREDGING AMERICA'S WATERWAYS AND HARBORS--MORE INFORMATION NEEDED ON ENVIRONMENTAL AND ECONOMIC ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07242

INDUSTRIAL SITING: ALLOCATING THE BURDEN OF POLLUTION,
For primary bibliographic entry see Field 6E.
W79-07244

UNNECESSARY AND HARMFUL LEVELS OF DOMESTIC SEWAGE CHLORINATION SHOULD BE STOPPED,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07262

INLAND BOUNDARY DETERMINATIONS FOR COASTAL MANAGEMENT PURPOSES - AN ECOLOGICAL SYSTEMS APPROACH TO REQUIREMENTS OF THE FEDERAL COASTAL ZONE MANAGEMENT ACT OF 1972,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6E.
W79-07270

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

CONSERVATION AND DEVELOPMENT IN OREGON'S COASTAL ZONE,
For primary bibliographic entry see Field 6E.
W79-07280

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION I,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07372

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION II,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07373

CLARENCE CANNON DAM AND RESERVOIR: COST, SCHEDULE, AND SAFETY PROBLEMS. CORPS OF ENGINEERS (CIVIL FUNCTIONS) DEPARTMENT OF THE ARMY,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 114, Price codes: A03 in paper copy, A01 in microfiche. July 1977, 23 p, 1 fig, 3 tab, 3 append.

Descriptors: *Hydroelectric power, *Electric power costs, *Earth-fill dams, *Benefit-cost ratio, *Clarence Cannon Dam(MO), Dams, Impoundments, Project benefits, Missouri, Reservoir construction, Safety factors, Corps of Engineers.

This is a critique of the Corps of Engineers' Clarence Cannon Dam and Reservoir project in northeastern Missouri. When completed, the reservoir will have about 285 miles of shoreline, serving drainage areas of 2,300 square miles above the main dam and 600 square miles below the main dam. Project benefit-cost ratio was predicted to be 1.3:1 in 1975. The cost of the project has more than tripled since 1962 and scheduled completion has been delayed 8 years. GAO questioned both the economic and financial feasibility of the hydroelectric power project, and whether adequate foundation safety was incorporated in phase 1 of the reservoir construction during 1970-72. Some of the earthen fill material used in construction contained a higher than acceptable moisture level and, as such, would tend to make the foundation unstable. The GAO recommends that the Corps provide further data on the financial and economic feasibility of the project's hydroelectric power capability and evidence that defective fill material in the dam

has been satisfactorily replaced or repaired. It also recommends that the Secretary of the Army obtain an overall evaluation of the safety of the dam from an expert independent consultant. (Arnold-NC)
W79-07383

PROCEEDINGS, NORTH CAROLINA 208 PROBLEM ASSESSMENT WORKSHOP, MAY 4, 1977, RALEIGH,
University of North Carolina, Water Resources Research Institute Raleigh Report No. 125, N.D., 55 p.

Descriptors: Management, Planning, Public participation, *208 planning, *Project planning, *Water quality requirements, North Carolina.

Objective of the workshop was to identify 208 program requirements presenting significant technical challenges to the State and to determine whether these requirements can be met within the limitations of current capabilities. Workshop format began with brief presentations by 208 program participants. Each participant discussed his group's accomplishments to date, projected accomplishmets over next two years with the present level of technology, and problem areas where assistance is needed. The Proceedings contain a record of presentations and comments made at the workshop. (Kiger-North Carolina)
W79-07391

URBAN HYDROLOGY IN SWEDEN--AN INVENTORY OF THE PROBLEMS AND THEIR COSTS,
Chalmers Univ. of Technology, Goteborg (Sweden).
L. Carlsson, and J. Falk.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 478-487, 1977. 5 fig, 5 tab, 26 ref.

Descriptors: *Urban hydrology, *Water management(Applied), *Surface runoff, *Water transport, *Water budget, *Subsurface water, *Waste water(Pollution), Effects, Urbanization, Costs, Hydrologic cycle, Water supply, Sewerage, Overflow, Storm water, Land subsidence, Environment, Economic impact, Pipes, Treatment facilities, Water utilization.

A model of the water budget for urban areas has been constructed as a basis for dividing the urban hydrological cycle into three storage and three transport parts. Within each part, problems and costs of water management are described. The total cost for management of water supply and sewerage in Sweden is estimated to be about 5.5 million Swedish crowns/day. The largest problems from the environmental viewpoint are considered to be the management of storm water and overflows. From the economic stance, land subsidence due to lowering of the piezometric head is a great problem. Management of the storm water must be performed on the assumption that it is partly a resource which can be handled and used within the urban area. This has given rise to extensive research regarding quantity and quality of storm water together with field experiments on artificial infiltration of storm water. In order to prevent damage to buildings, roads, conduit systems, etc., due to land subsidence, instructions for underground planning and building are in preparation. (See also W79-07426) (Bell Graf-Cornell)
W79-07479

BENEFITS AND COSTS OF URBAN DRAINAGE AND FLOOD CONTROL PROJECTS,
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
N. S. Grigg.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 558-564, 1977. 3 fig, 4 tab, 5 ref.

Descriptors: *Urban drainage, *Flood control, *Benefits, Evaluation, Costs, Planning, Investment, Cost effectiveness, Probability density function.

In recent urban development, drainage and flood control projects have often lost out to higher priority public investments. These projects suffer from a lack of visibility and their full costs and benefits need to be carefully identified by the responsible officials. Distinctions should be drawn between major and minor systems. Current practice is to use a 'design storm' approach to planning. This fixed-effectiveness, minimum cost approach may not produce an optimum plan. Benefits and costs of projects are listed and classified as well as related to project objectives. The role of intangible benefits and costs is described. (See also W79-07426) (Bell Graf-Cornell)
W79-07487

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GROUND-WATER DEPLETION, IN FEET, ALLOWED IN CENTRAL LEA COUNTY, NEW MEXICO, BY U.S. INTERNAL REVENUE SERVICE FOR CALENDAR YEAR 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
New Mexico State Engineer Map LC-21, 1979. 1 sheet.

Descriptors: *Maps, *Groundwater, *Water levels, *New Mexico, *Taxes, Irrigation water, Water loss, *Groundwater depletion, *Tax claims, *Central Lea County(N Mex), Internal Revenue Service.

Map at the scale of 1/2-inch per mile shows areas in central Lea County, New Mexico, where values of water level, in feet, have been assigned for the year 1978. This map has been prepared cooperatively by the New Mexico State Engineer and the U.S. Geological Survey. It is a guideline map, approved by the U.S. Internal Revenue Service, to be used by landowners in irrigated areas of Lea County to calculate water-depletion losses for income tax purposes. The map is numbered LC-21. Copies may be obtained from the office of the New Mexico State Engineer. (Woodard-USGS)
W79-07015

GROUND-WATER DEPLETION, IN FEET, ALLOWED IN NORTHERN LEA COUNTY, NEW MEXICO, BY U.S. INTERNAL REVENUE SERVICE FOR CALENDAR YEAR 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
New Mexico State Engineer Map LN-21, 1979. 1 sheet.

Descriptors: *Maps, *Groundwater, *Water levels, *New Mexico, *Taxes, Irrigation water, Water loss, *Groundwater depletion, *Tax claims, *Northern Lea County(N Mex), Internal Revenue Service.

Map at the scale of 1/2-inch per mile shows areas in northern Lea County, New Mexico, where values of water level, in feet, have been assigned for the year 1978. This map has been prepared cooperatively by the New Mexico State Engineer and the U.S. Geological Survey. It is a guideline map, approved by the U.S. Internal Revenue Service, to be used by landowners in irrigated areas of Lea County to calculate water-depletion losses for income tax purposes. The map is numbered LN-21. Copies may be obtained from the office of the New Mexico State Engineer. (Woodard-USGS)
W79-07016

GROUND-WATER DEPLETION, IN FEET, ALLOWED IN A PART OF CURRY COUNTY, NEW MEXICO, BY U.S. INTERNAL REVENUE SERVICE FOR CALENDAR YEAR 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
New Mexico State Engineer Map CU-19, 1979. 1 sheet.

Descriptors: *Maps, *Groundwater, *Water levels, *New Mexico, *Taxes, Irrigation water, Water loss, *Groundwater depletion, *Tax claims, *Curry County(N Mex), Internal Revenue Service.

Map at the scale of 1/2-inch per mile shows areas in Curry County, New Mexico, where values of water level, in feet, have been assigned for the year 1978. This map has been prepared cooperatively by the New Mexico State Engineer and the U.S. Geological Survey. It is a guideline map, approved by the U.S. Internal Revenue Service, to be used by landowners in irrigated areas of Curry County to calculate water-depletion losses for income tax purposes. The map is numbered CU-19. Copies may be obtained from the office of the New Mexico State Engineer. (Woodard-USGS)
W79-07017

GROUND-WATER DEPLETION, IN FEET, ALLOWED IN PORTALES VALLEY, ROOSEVELT COUNTY, NEW MEXICO BY U.S. INTERNAL REVENUE SERVICE FOR CALENDAR YEAR 1978,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
New Mexico State Engineer Map RO-22, 1979. 1 sheet.

Descriptors: *Maps, *Groundwater, *Water levels, *New Mexico, *Taxes, Irrigation water, Water loss, *Groundwater depletion, *Tax claims, *Roosevelt County(N Mex), Internal Revenue Service.

Map at the scale of 1/2-inch per mile shows areas in Roosevelt County, New Mexico, where values of water level, in feet, have been assigned for the year 1978. This map has been prepared cooperatively by the New Mexico State Engineer and the U.S. Geological Survey. It is a guideline map, approved by the U.S. Internal Revenue Service, to be used by landowners in irrigated areas of Roosevelt County to calculate water-depletion losses for income tax purposes. The map is numbered RO-22. Copies may be obtained from the Office of the New Mexico State Engineer. (Woodard-USGS)
W79-07018

AN ASSESSMENT OF THE FINANCIAL IMPACT OF FEDERAL GUIDELINES ON THE CANADIAN METAL FINISHING INDUSTRY,
Department of the Environment, Ottawa (Ontario). Water Pollution Control Directorate.
L. Buffa, and K. R. Coulter.
Economic and Technical Review Report EPS 3-WP-78-8, December 1978, 40 p, 2 fig, 7 tab, 6 ref, 1 app.

Descriptors: *Economic impact, *Cost analysis, *Financial feasibility, Legislation, Pollution abatement, Treatment facilities, Industrial production, Operating costs, Installation costs, *Metal Finishing Liquid Effluent Guidelines, *Metal Finishing Industries.

This report is an assessment of the ability of the Canadian metal finishing industry to absorb the cost of meeting the Metal Finishing Liquid Effluent Guidelines issued in November, 1977. Capital and operating costs for pollution abatement equipment are given in 1976 values. The increase in capital and operating costs can be estimated at approximately 15 percent for 1978 values. Only noncaptive, independent metal finishing installations have been assessed, on the assumption that captive operations which are only a part of a larger company will be able to meet the requirements with available financial resources. (WATDOC)
W79-07216

ADOPTION OF THE REASONABLE USE RULE IN NORTH CAROLINA FOR SURFACE WATER DRAINAGE BETWEEN ADJOINING LANDOWNERS,
For primary bibliographic entry see Field 6E.
W79-07235

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07241

AN ALTERNATIVE PERSPECTIVE ON COMMON PROPERTY RESOURCE ALLOCATION DECISIONS IN THE COASTAL ZONE,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 6E.
W79-07274

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

CLARENCE CANNON DAM AND RESERVOIR: COST, SCHEDULE, AND SAFETY PROBLEMS. CORPS OF ENGINEERS (CIVIL FUNCTIONS) DEPARTMENT OF THE ARMY,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-07383

PROCEEDINGS, NORTH CAROLINA WORKSHOP ON WATER AND WASTEWATER PRICING, FEBRUARY 21, 1978, RALEIGH,
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
N.D., 76 p.

Descriptors: *Wastewater, Pricing, *Water pricing, *Water management, Rate setting, Conservation.

Prices for water and wastewater services vary considerably between communities because each system is unique. Some factors which cause prices to vary include location of the supply, topography or terrain, age of the system, population density, type of consumer, area being served, growth, water quality and quantity, inflation and energy costs, fire facilities, general tax and level of treatment. The pricing of water and wastewater services is going up and utility managers need to be in a better position to explain new rate structures. New issues force us to review traditional approaches to rate setting. These issues include: inflation, growth management, government regulations, especially those associated with the Clean Water Act and the Safe Drinking Water Act, energy costs, chemical costs, and the need for conservation. This workshop raised issues related to establishing equitable rate structures which reflect the costs and services being provided and anticipated future needs. The general objective of the workshop is to provide a forum for leaders to discuss these issues and to hear experts discuss national pricing trends. Specific objectives were: to present information on advanced approaches to rate setting; to demonstrate the relationship between water and wastewater pricing; to discuss unique problems of pricing in North Carolina; to present practical methods for solving pricing problems; to determine needs for training, research and further workshops; and to present the opportunity to use water conservation as a management tool to reduce costs. (Kiger-North Carolina)
W79-07390

WATER CONSERVATION VIA A VARIABLE PRICING MECHANISM,
Kentucky Univ., Lexington.
C. T. Haan, D. I. Carey, and O. C. Grunewald.
In: Effects of Urbanization and Industrialization on the Hydrological Regime and on Water Quality. Proceedings of the Amsterdam Symposium, October 1977. IAHS-AISH Publication No. 123, International Association of Hydrological Sciences, p 213-225, 1977. 3 fig, 2 tab, 16 ref.

Descriptors: *Water conservation, *Pricing, *Water supply, *Simulation analysis, *Stochastic processes, Water demand, Water rates, Water policy, Evaluation, Kentucky, Benefits, Costs, Equations, Mathematical models, Systems analysis, Alternative policies.

Increasing demands for water for urbanizing areas has demonstrated that it is no longer possible to meet 'all foreseeable demands' for water. Curtailment of water usage can be implemented through the pricing structure of the water to consumers. An increase in water rates has been shown to reduce the consumption of water. By using a variable pricing strategy it is possible to meet the demands for water when water is plentiful and yet to conserve water in times of shortage. The strategy consists of making water rates a function of available water so that the rates are low when water is in good supply and rates are increased when the supply is low. A policy of this nature has been shown to greatly reduce the capacity of a water supply system needed to meet the demands placed on it without greatly decreasing the amount of water supplied or increasing the average price of water. Various pricing policy alternatives are evaluated using a stochastic simulation analysis and a water price-demand relationship derived from more than 150 water districts in the state of Kentucky, USA. (See also W79-07426) (Bell Graf-Cornell)
W79-07449

6D. Water Demand

OPTIMUM WATER MANAGEMENT IN KAOLIN MINING FOR ALUMINUM PRODUCTION,
Georgia Inst. of Tech., Atlanta, GA.
J. E. Husted, F. G. Pohland, J. W. Wallace, and G. Dodson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 729, Price codes: A07 in paper copy, A01 in microfiche. Final Report SEGIT-78-178, November 1978. 126 p, 32 fig, 27 tab, 34 ref. OWRT C-7208 (No. 6229) (1), 14-34-001-6229.

Descriptors: *Kaolinite, *Strip mining, Georgia, Industrial water, Water demand.

The report is concerned with approximately 2700 square miles in east-central Georgia that includes parts of Glascock, Jefferson, McDuffie, Twiggs, Warren, Washington, and Wilkinson counties. Kaolin reserves for this area are estimated to be in excess of 3.5 billion short tons. An assessment of both groundwater and surface water resources includes piezometric surfaces, regional transmittivity, and potential drawdowns. Current water users and treatment facilities as well as waste water treatment facilities are also given. Projections are made of future water demand and waste water treatment impact. Water demand for processing alumina may range from 3 to 25 MGD, being dependent on process method and annual production rate of alumina that may vary between 300,000 and 1,000,000 short tons. Water in the northeast portion of the region is less abundant than in the central and southwest portions. Water should be sufficient for an alumina operation within 5 to 10 miles of a plant in the northeast and within a mile or less in other portions of the area.
W79-07129

RE-USE--THE ESSENTIAL ELEMENT IN WATER UTILIZATION,
Pretoria Univ. (South Africa).
F. A. van Duuren.
VELDTRUST, p 6-7, Autumn 1978, 2 fig.

Descriptors: *Water reuse, *Water utilization, *Competing uses, *Consumptive use, *Impaired water use, *Irrigation, *Industrial plants, Water quality, Water supply, Domestic water, Water consumption, Industrial water, Pulp and paper industry, Effluents, Reclaimed water, South Africa.

A system approach to the efficient utilization of available water supplies in South Africa is essential in prventing a potential water shortage. Because any use of water degrades it, its quality must be reviewed and quality requirements of subsequent reuse must be critically assessed. At the current population level of 24 million the domestic sector uses 7% of the available water supply; industry uses 18%, and agricultural irrigation uses the remaining 75%. When the population reaches 50 million domestic use will be at 15%, industry at 45% and irrigation at 40%. Since less than half of the water is used consumptively by the domestic sector, and only a small portion is used consumptively by industry, and virtually all agriculture use is consumptive, it is concluded that irrigation should not be allowed first draught on available water supplies. In urban perimeters where domestic effluent quality and the required quality of irrigation are equal, irrigation has become a secondary user of domestic effluent. Certain industries can also use domestic effluents. At the end of the century the domestic sector will be the smallest consumer, therefore it should be apportioned prime use of available supplies. Planned reuse of water in industry in South Africa is very extensive. The pulp and paper industry at Springs is an outstanding example of reuse of urban effluent. Its oxygen bleach process limits the addition of dissolved solids and thus enhances reuse of water. (Davison-IPA)
W79-07179

THE CHURCHILL DIVERSION: WATER QUALITY CHANGES IN THE LOWER CHURCHILL AND BURNTWOOD RIVERS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
R. A. Guilbault, W. D. Gummer, and V. T. Chacko.
Water Quality Interpretive Report No. 2, 1979, 9 p, 4 fig, 8 ref, 4 tab.

Descriptors: *Hydroelectric power, *Diversion, *Diversion losses, *Diversion dams, Alteration of flow, Water quality control, *Manitoba, *Churchill River, *Burntwood River, *Fidler Lake, *Granville Falls.

In June of 1976, Manitoba Hydro commenced operation of the Churchill River diversion, which is part of the Churchill-Nelson Hydroelectric Development Scheme. A statistical analysis of data obtained from a water quality monitoring network maintained in northern Manitoba by the Water Quality Branch indicates changes in the quality of both the lower Churchill and Burntwood Rivers. On the lower Churchill there is evidence of increases in turbidity, colour, total inorganic carbon, total phosphorus, hardness, calcium and aluminum. On the Burntwood River there is evidence of a decrease in calcium concentration and increases in total phosphorus, potassium and aluminum concentrations. A large number of parameters showed a change in their variability. The magnitude and cause of the water quality changes cannot be quantified precisely, since the data base used was not collected with this purpose in mind. Many of the results of this study are in agreement with the general predictions made in 1975 by the Lake Winnipeg, Churchill and Nelson Rivers Study Board. (WATDOC)
W79-07208

A GEOGRAPHICAL ANALYSIS OF TRENDS IN UNITED STATES WATER RIGHTS LAWS (WITH EMPHASIS ON THE SOUTHEASTERN STATES),
Michigan Univ., Ann Arbor. Dept. of Geography.
For primary bibliographic entry see Field 6E.
W79-07258

WATER CONSERVATION: RESIDENTIAL IMPACTS,
Arizona State University, Tempe. Faculty of In-

dustrial Engineering.
For primary bibliographic entry see Field 3D.
W79-07388

6E. Water Law and Institutions

DEVELOPMENT DOCUMENT FOR INTERIM FINAL EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE MINERALS FOR THE CONSTRUCTION INDUSTRY. VOL. 1. MINERAL MINING AND PROCESSING INDUSTRY,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 593, Price codes: A13 in paper copy, A01 in microfiche. Report EPA 440/1-75/059, 1975. 280 p, 20 fig, 24 tab, 45 ref.

Descriptors: *Federal Water Pollution Control Act, *Standards, *Mine water, *Construction materials, *Waste water treatment, Minerals, Regulation.

Effluent limitation guidelines are proposed for the construction industry segment of the mineral mining indudtry for existing point sources and standards of performance and pretreatment standards for new sources. The limitations will implement Sections 301, 304, 306, and 307 of the Federal Water Pollution Control Act. The limitation guidelines set forth the degree of effluent reduction attainable through the application of the best available technology economically achievable and the degree of effluent reduction attainable through the application of the best practicable control technology currently available. Based on the application of best practicable technology currently available, six of the nine production categories (15 minerals) can be operated with no discharge of process generated waste water pollutants to navigable waters. This is also true for eight of nine subcategories with the best available technology economically achievable. No discharge is achievable as a new source performance standard for all production subcategories except mica, wet benefication process with ceramic clay as by-product. Supporting data and rationale for development of the proposed guidelines and standards of performance are included. (Small-FRC)
W79-07051

STATE LEGISLATIVE CONSTRAINTS ON THE DEVELOPMENT OF WATER RESOURCES POLICY,
West Virginia Univ., Morgantown. Dept. of Political Science.
D. C. Menzel.
Water Resources Bulletin, Vol. 14, No. 6, p 1331-1339, December 1978. 4 tab, 4 ref. OWRT A-032-WVA(2). 14-34-0001-7104.

Descriptors: *Legislation, *Constraints, *Water resources development, *Water policy, State governments, Institutional constraints, Political constraints, Water pollution, Decision making.

Legislative constraints on the development of water resources policy fit into three broad categories: political, institutional, and informational. The political category encompasses constituency needs and preferences, satisfaction with existing water management practices and policies, and the necessity for legislators to blend political ambition with public problem solving. Constraints fitting into the institutional category include differences in legislative behavior and attitudes that stem from one's location in the legislature (e.g., senate-house, leader-follower, or committee activity), the dynamics of scheduling and organization, and the capability to manage complex issues. Informational constraints refer to the availability of information and the use to which it is put by lawmakers in formulating decisions on water-related issues. These constraints are approached from a behavior perspective by examining several constituency, institutional, and information hypotheses that 'explain' legislative involvement with water resources issues. The data are drawn from a recent study of water resources decision making in West Virginia. Eighty-three of the 134 members of the 1975-76 West Virginia Legislature participated in the study. (Bell Graf-Cornell)
W79-07102

SURVEY AND EVALUATION OF SOCIAL SCIENCE RESEARCH ON FLOOD-DAMAGE ABATEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 6F.
W79-07130

PRETREATMENT REGULATIONS FOR EXISTING AND NEW SOURCES OF POLLUTION,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 123, p 27736-73, June 26, 1978.

Descriptors: *Waste water treatment, *Industrial wastes, *Waste treatment, *Regulation, Treatment facilities, Standards, Environmental sanitation, Public utilities, Discharge(Water), Recycling, Reclaimed water.

This proposed rule of the federal Environmental Protection Agency (EPA) establishes mechanisms and procedures for enforcing national pretreatment standards controlling the introduction of nondomestic wastes into publicly owned treatment works (POTW's). The regulation's preamble and Appendix A describe the EPA's overall policy for establishing and enforcing pretreatment standards for new and existing industrial users of POTW's, and they delineate the responsibilities and deadlines applicable to each party. The intent of this regulation and the national pretreatment policy is to: (1) prevent the introduction of pollutants into POTW's which will (2) interfere with the POTW's operation or contaminate the sewage sludge and (3) pass through the treatment works into receiving waters or the atmosphere or otherwise be incompatible with the work; and (4) improve opportunities to recycle and reclaim wastewaters and sludge resulting therefrom. These pretreatment standards will include general discharge prohibitions applicable to all POTW users who discharge nondomestic wastes, as well as standards applicable to specific industrial categories. The discharge limits will be promulgated in separate regulations. (Greene-Florida)
W79-07231

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: AN OVERVIEW (VOLUME 1),
Wisconsin Univ.-Madison. Law School.
D. W. Large.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 120, Price codes: A04 in paper copy, A01 in microfiche. Report EPA 600/2-77-232, November, 1977, 60 p.

Descriptors: *Waste water disposal, *State governments, *Riparian rights, *Appropriation, Groundwater, Surface waters, Surface-groundwater relationships, Watercourses(Legal aspects), Competing uses, Analysis, Water rights, Water utilization.

State water rights laws and their possible impact on systems of land application of wastewater are discussed and analyzed. Most states have no regulations specifically controlling land application of wastewater. An analysis must be undertaken of basic state water law principles which have been mostly developed with entirely different water uses in mind. Several basic dichotomies could have some impact on the treatment of land application systems in different locations. The eastern 'riparian' states emphasize each riparian landowner's right along a watercourse to the use of water. The western 'appropriation' states emphasize that the right inures to the prior user of water. Most states in both the riparian and appropriation categories distinguish between 'natural watercourses,' 'surface water,' and 'groundwater,' with different legal considerations and results frequently occurring in different water categories in the same state. Occasional abstract legal requirements of absolute water purity, if literally applied, could pose adverse implications for innovative water uses. Most state water rights law contains enough flexibility, through its emphasis on encouraging 'reasonable' water uses, to enable land application systems to operate free from legal uncertainty. (Greene-Florida)
W79-07232

IMPROVEMENTS NEEDED BY THE WATER RESOURCES COUNCIL AND RIVER BASIN COMMISSIONS TO ACHIEVE THE OBJECTIVES OF THE WATER RESOURCES PLANNING ACT OF 1965,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 552, Price codes: A02 in paper copy, A01 in microfiche. Report October 31, 1977, 14 p.

Descriptors: *Water resources planning act, *Comprehensive planning, *Future planning(Projected), Coordination, Water conservation planning, Reviews, Water management(Applied), Adoption of practices, Water resources development.

Failure of the federal Water Resources Council and state river basin commissions to meet the objectives of the 1965 Water Resources Planning Act and to develop coordinated and comprehensive national, regional and state plans called for under the Act, caused the Federal General Accounting Office to make three general recommendations. First, the Council and commission chairmen should jointly prepare guidelines for (1) preparation and review of comprehensive, corrdinated joint plans and priority reports and (2) clarification of the working relationships among the Council, commissions, state, and their members. At the least, these guidelines should include: (1) a description of the essential elements to be included in regional plans; (2) format so that plans may be compared among regions; and (3) procedure detailing how these plans will be reviewed, processed, and used at the various governmental levels. Secondly a more aggressive role should be taken in bringing unresolved matters to the attention of Council members for resolution. And thirdly, if the Council, commissions and their members should decide the issues in this report cannot be adequately resolved, then the Council chairman should propose legislation to establish an entity with the authority to accomplish the objectives of the 1965 Act. (Greene-Florida)
W79-07233

TRANSFRONTIER POLLUTION: PLAINTIFF CAN CHOOSE HIS COURT,
For primary bibliographic entry see Field 5B.
W79-07234

ADOPTION OF THE REASONABLE USE RULE IN NORTH CAROLINA FOR SURFACE WATER DRAINAGE BETWEEN ADJOINING LANDOWNERS,
R. M. Koch.
Wake Forest Law Review, Vol. 14, No. 4, p 866-81, August, 1978.

Descriptors: *North Carolina, *Surface drainage, *Judicial decisions, *Water rights, Surface runoff, Common law, Drainage effects, Civil law, Reasonable use, Drainage practices, Damages.

Three basic rules govern the rights of adjoining landowners with respect to the drainage of surface water: (1) the civil law rule; (2) the common enemy rule; and (3) the reasonable use rule. The common enemy rule states that 'surface water is recognized as a common enemy which each proprietor may fight off or control as he will or is able. No cause of action arises from such interference. The civil law rule states that a person who interferes with the natural flow of surface waters so as to cause an invasion of another's interests in

the use and enjoyment of his land is subject to liability to the other. The reasonable use rule allows each landowner to make a reasonable use of his land even though he alters the flow of surface water, thereby harming other landowners. North Carolina has traditionally followed a modified version of the civil law rule. However, in the 1977 case of Pendergrast v. Aiken the state's Supreme Court formally adopted the reasonable use rule as a guideline for settlement of future drainage controversies. (Goldberg-Florida)
W79-07235

WATER, WATER EVERYWHERE: POWER FLOWS IN THE LOWER RIO GRANDE VALLEY,
San Francisco Univ., CA.
For primary bibliographic entry see Field 2E.
W79-07236

FINANCIAL RESPONSIBILITY FOR WATER POLLUTION,
Federal Maritime Commission, Washington, DC.
Federal Register, Vol. 43, No. 156, p 35704-18, August 11, 1978.

Descriptors: *Oil pollution, *Cost repayment, *Regulation, *Navigable waters, Reimbursable costs, Insurance, Federal water pollution control act, Oil spills, Barges, Water pollution, Administrative agencies, Ships.

Part 542 of the Federal Marine Commission's rules has been revised to conform to the requirements of the 1977 Clean Water Act Amendments to the Federal Water Pollution Control Act. Part 542 establishes procedures whereby vessel operators may demonstrate the financial ability to meet their liability to the United States for the costs of removing oil and other polluting substances discharged into any waters over which the United States has jurisdiction. Vessels subject to these regulations must obtain Certificates of Financial Responsibility from the Commission in order to be authorized to use the navigable waters of the United States or any port or place therein. The various objections to and revisions of the proposed regulations are discussed in the supplementary information to the rule. Included in the finally adopted legislation are applicable definitions; the scope of the legislation; certificate application procedures, and requirements; how to establish financial responsibility for meeting liability; enforcement procedures, conditions that may result in denial or revocation; and other rule provisions. (Horwich-Florida)
W79-07237

WETLAND PROTECTION IN COMPLIANCE WITH NEPA,
Soil Conservation Service, Washington, DC.
Federal Register, Vol. 43, No. 127, p 28787-88, June 30, 1978.

Descriptors: *Wetlands, *Soil conservation, *Priorities, *Regulation, Aquatic life, Food and cover crops, Crop production, Drainage, Flood control, Assessments, Tidal marshes, Watershed management.

The rules proposed herein codify Soil Conservation Service (SCS) policy for compliance with Executive Order 11990, relating to the Protection of Wetlands in SCS assisted programs. The valuable functions of wetlands are described; for example, wetlands serve as flood-control mechanisms, water purifiers, nurseries for certain aquatic animal species, and ground-water recharge areas. On the other hand, many wetlands, if drained, could be used as prime cropland for the production of food and fiber. This proposed rule sets the policy guidelines to be used in balancing the needs for protection of environmental resources and the needs for food and fiber. An environmental assessment must be made in the early stages of planning, to identify effects of proposed actions that will occur in wetlands. Some factors to be weighed in the environmental assessment are the public health, safety, and welfare, including consideration of: water supply and flood hazards; the maintenance of natural systems; and other public uses of wetlands, such as recreational and scientific uses. (Horwich-Florida)
W79-07238

WATER QUALITY STANDARDS,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 132, p 29588-92, July 10, 1978.

Descriptors: *Water quality standards, *Pollution abatement, *Administrative agencies, *Standards, Water pollution, Water policy, Water pollution control, Water supply, Water utilization, Regulation, Water quality control, Pollution.

Water quality standards may form the basis for enforceable requirements under the federal Clean Water Act. Water quality standards may also form the basis for the areawide planning requirements under section 208 of the Act. Water quality standards may thus be translated into enforceable requirements not only for 'point' sources, but also for 'non-point' sources. The federal Environmental Protection Agency (EPA) here summarizes its current policy for development of water quality standards and its preliminary thoughts for a revised approach. A water quality standard for a particular water body (or segment) will generally consist of two elements: (1) a designated 'use' (such as public water supply, recreation, agriculture, etc.); and (2) 'criteria' for various pollutants, expressed in numerical concentration limits, sufficient to support the designated use. The EPA's contemplated approach would result in: (1) more stringent water quality standards than currently exist in many states; and in (2) water quality standards for many pollutants which are not subject to existing state standards. The EPA is currently contemplating a revised approach in order to assure achievement of the Clean Water Act's goals and to comply with a court order. (Fortin-Florida)
W79-07239

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS IN MISSISSIPPI,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 135, p 30076-78, July 13, 1978.

Descriptors: *Mississippi, *Water quality standards, *Dissolved oxygen, *Legislation, State jurisdiction, Regulation, Water pollution control, Water quality control, Water quality, Pollution abatement, Pollutant identification.

In July, 1977, the federal Environmental Protection Agency (EPA) disapproved the dissolved oxygen criteria of the water quality standards adopted by the Mississippi Air and Water Pollution Control Commission for the state of Mississippi. The EPA herein proposes a rule establishing dissolved oxygen criteria for the navigable waters of Mississippi. Section 303 (c) of the federal Clean Water Act (Act) requires that the State water quality standards 'be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of this act.' Among the more important quality criteria describing water quality suitable for the maintenance and propogation of fish's dissolved oxygen. The EPA criterion for dissolved oxygen recommends that the minimum daily dissolved oxygen not be less than 5.0 mg/1 to support a well balanced population of fish species. The EPA's proposed rule would establish a three-part standard. Current state standards for dissolved oxygen remain in effect until the EPA finally promulgates more stringent standards. The water quality standards applicable to intrastate, interstate, and coastal waters of Mississippi were subsequently amended on June 1978. (Fortin-Florida)
W79-07240

WATER QUALITY STANDARDS FOR NAVIGABLE WATERS OF ALABAMA,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 188, p 43741-43, Sept. 27, 1978.

Descriptors: *Water quality standards, *Pollution abatement, *Regulation, *Alabama, Water pollution, Water pollution control, Water supply, Water utilization, Pollution classification, Administrative agencies, Adoption of practices.

Section 303 (c) of the federal Clean Water Act provides that each state shall, at least once every three years, hold public hearings to reviewing water quality standards and to adopt revisions therein. Whenever a state revises or adopts new water quality standards, such standards must be submitted to the federal Environmental Protection Agency (EPA) for approval. If the standards are unacceptable to the EPA, the state has 90 days to re-adopt or re-amend them. Failing this, the EPA may enact interim standards for the state. This proposal is such an interim rule for Alabama. The EPA's proposed rule would establish a designated use classification of Fish and Wildlife for 23 stream segments. A significant difference exists between the water quality criteria associated with the Agricultural and Industrial Water Supply use. The EPA's proposed rule would also result in the application of a more stringent toxic substance provision than the one assigned by Alabama for the Agricultural and Industrial Water Supply use classification. Water quality standards will be achieved by the installation of point source abatement controls; by the application of more effective operation of existing point source facilities; or by the application of best management practices for non-point pollution sources. (Fortin-Florida)
W79-07241

DREDGING AMERICA'S WATERWAYS AND HARBORS--MORE INFORMATION NEEDED ON ENVIRONMENTAL AND ECONOMIC ISSUES,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 802, Price codes: A04 in paper copy, A01 in microfiche. Report to the Congress June 28, 1977, 64 p.

Descriptors: *Dredging, *Environmental effects, *Disposal, *Cost analysis, Economic feasibility, Alternative planning, Alternative costs, Water pollution sources, Rivers and harbors act, Adoption of practices, Regulation.

Concern has increased over possible environmental damage associated with the open water sediment disposal practices of the U.S. Army Corps of Engineers near waterway and harbor dredge sites. Alternatives to traditional disposal sites may reduce or eliminate suspected environmental risks, but they generally increase costs and affect the economic feasibility of projects. The 1970 Rivers and Harbor Act directed the Corps to research the effects of, and alternatives to traditional disposal practices. Preliminary research results indicate open water disposal is not as environmentally harmful as first believed, although long-term effects remain unknown. Because the Environmental Protection Agency (EPA) is responsible for guidelines on dredged material disposal and criteria applicable to this research, it should begin full-time participation in the remainder of the Corp's research and any subsequent program. For those dredging projects where the EPA objects to the Corps' disposal practices, the Corps should include in its budget justifications: (1) the cost of changing from current practices; (2) a description of current and proposed disposal methods; (3) the reasons for suggested disposal method changes including expected environmental benefits; (4) the proposed changes' effect on the project's economic feasibility. (Greene-Florida)
W79-07242

HISTORY, POLITICS AND THE LAW OF THE CALIFORNIA TIDELANDS TRUST,
Western State Univ. Coll. of Law, Fullerton, CA.
C. E. Parker.
Western State University Law Review, Vol. 4, No. 2, p 149-97, Spring, 1977.

Descriptors: *California, *Coasts, *Land classification, *Tides, Tidal waters, Federal government, State governments, High water mark, Adverse possession, Legislation, Reclamation, Public land.

Tidelands are those lands affected by the ebb and flow of the tide. The dividing line between tidelands and uplands is determined by averaging high water marks. Land below the mean high water line is held by the state in the public trust. However, many thousands of acres of California's tidelands have been patented to private persons through their incorrect classification as swamp and overflowed lands, which are supposed to be above the mean high water line. A multitude of legal issues has arisen from this erroneous classification and sale of California's tidelands. In analyzing the status of the titles to certain lands along the California coastline, the roles of the California legislature, executive branch, and judiciary, state and federal constitutions, adverse possession, and the role of the federal government are discussed. A resolution to the unmarketability of these titles is proposed. Although California may be barred by its Constitution from enacting legislation to stabilize the marketability, the federal government could, under the Commerce Clause, enact legislation insuring present and future loans secured by tidelands, in the event of sovereign reclamation. (Horwich-Florida)
W79-07243

INDUSTRIAL SITING: ALLOCATING THE BURDEN OF POLLUTION,
W. G. Murray, Jr., and C. J. Seneker, II.
Hastings Law Journal, Vol. 30, No. 2, p 301-36, January, 1979.

Descriptors: *Industrial wastes, *Permits, *Construction, *Water pollution control, Federal water pollution control act, Permits, Administrative agencies, Alternative planning, Facilities, Comprehensive planning, Sites.

The diffusion among numerous federal and state agencies of environmental regulations for industrial siting creates three basic difficulties for industrial and conservation interests. First, there is no incentive or opportunity for comprehensive resource planning; second, existing agencies have limited jurisdiction and vested interests in protecting only one resource or serving limited constituencies; and lastly, the large number of permits required creates unacceptable time delays, uncertainty in development process and uncontrollable costs. Examples of federal regulation affecting industrial siting through their systems of permit and licensing requirements are the Clean Air Act, the National Environmental Policy Act, and the 1972 Federal Water Pollution Act Amendments (FWPCA). Under the FWPCA, permits are required from the state, EPA, and the Department of the Army. These federal requirements are in addition to state and local zoning and planning authority. The creation of a master siting agency, which would grant all permits necessary at the state level for a proposed site, would alleviate time delays and problems of competing resource demands. Enabling the agency to make a decision consistent with state development plans and siting legislation would be the Master Application.
W79-07244

THOUGHTS ON THE ROLE OF PENALTIES IN THE ENFORCEMENT OF THE CLEAN AIR AND CLEAN WATER ACTS,
Reed, Smith, Shaw and McClay, Pittsburgh, PA.
D. McN. Olds, J. C. Unkovic, and J. L. Lewin.
Duquesne Law Review, Vol. 17, No. 1, p 1-31, 1978-79.

Descriptors: *Regulations, *Penalties(Legal), *Law enforcement, *Water quality control, Federal water pollution control act, Clean air act, Legislation, Industrial wastes, Municipal wastes, Water policy, Permits, State governments.

The regulatory systems mandated by the federal Clean Air Act and the Federal Water Pollution Control Act are now firmly established. The federal Environmental Protection Agency (EPA) can now devote more attention to enforcement. This anticipated emphasis on enforcement raises certain legal and practical questions concerning the role of civil and criminal penalties. Sanctions under the Air and Water Acts, federal regulation before 1970, legal criteria governing imposition of civil and criminal penalties, and liability of corporations and their employees are discussed and analyzed. A comprehensive enforcement strategy is needed but difficulties in developing it are forseen. Among the anticipated problems are the prosecutorial discretion of agencies, confusion created by ambiguity in the Acts, and the fact that each state may have a different scheme of penalties. Although no single comprehensive enforcement policy statement has been issued, broad guidelines have been set forth in a series of speeches and memoranda from EPA enforcement personnel. For example, indications are that criminal sanctions will be used sparingly, with emphasis being placed on civil penalties. While the guidelines are still limited, they are a first step toward a comprehensive enforcement policy. (Horwich-Florida)
W79-07245

THE SOUTH CAROLINA COASTAL ZONE MANAGEMENT ACT OF 1977,
B. W. Wyche.
South Carolina Law Review, Vol. 29, No. 4, p 666-703, Sept. 1978.

Descriptors: *South Carolina, *Wetlands, *Legislation, *Shore protection, Tidelands, Permits, Beaches, Coasts, Accretion(Legal aspects), Erosion control, Regulation, Environmental control.

By 1972, every Atlantic Coast state except South Carolina had enacted legislation regarding what is perhaps the most critical resource of the coastal zone: the wetlands. That year, Congress also passed the federal Coastal Zone Management Act (CZMA) to encourage the states to extend this authority to all their coastal zones. South Carolina finally enacted its CZMA in 1977. Events leading up to this enactment are reviewed, and major provisions of the state law are discussed. Basically the Act establishes the South Carolina Coastal Council and requires it to develop and enforce a state CZM program and to exercise permitting control over various activities. One problem for this CZM plan is that it may be insufficient to meet the federal CZMA funding requirements. South Carolina's jurisdiction is limited by the Act to 'critical areas,' which means that activities within upland areas adjacent to coasts will not require permits, even if the activity directly and significantly affects coastal waters. The Act should be amended. Also discussed are the permit program, judicial review, accreted land, erosion control, the public trust doctrine, Corps of Engineers' role, and the taking doctrine. (Horwich-Florida)
W79-07246

GROUNDWATER POLLUTION IN SOUTH DAKOTA: A SURVEY OF FEDERAL AND STATE LAW,
C. L. Srstka.
South Dakota Law Review, Vol. 23, No. 3, p 698-734, Summer, 1978, 3 fig.

Descriptors: *South Dakota, *Groundwater, *Water pollution control, *Water quality control, Hydrology, Geology, Hydrogeology, Agricultural runoff, Legislation, Common law, Water pollution sources, Water resources.

Because national concern regarding water pollution has centered around surface water cleanup, the problem of groundwaters deterioration has been neglected for years. More attention must be given to groundwater. It is a major source of water supply, and groundwater pollution may pollute surface waters into which it is discharged. This comment discusses groundwater pollution problems in South Dakota and the adequacy of the law that has developed these to control those problems. Various sources of groundwater pollution are listed. Of particular concern to South Dakota are modern agricultural practices, such as intensive irrigation. The basic concepts of geology, hydrology, and hydrology of groundwater are explained, as are judicial and legislative treatments of groundwater. The law as it stands now is inadequate largely because of the failure of lawmakers to comprehend the physical facts and characteristics of groundwater. Relevant federal statutory and case law, South Dakota statutes, and common law remedies available to the individual are examined. Federal law has a negligible effect on groundwater pollution in South Dakota, and the ultimate burden of regulating groundwater pollution lies with the states. (Horwich-Florida)
W79-07247

AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL UNDER SECTIONS 208 AND 303 OF THE CLEAN WATER ACT: HAS FORTY YEARS OF EXPERIENCE TAUGHT US ANYTHING,
L. L. Schloesser.
North Dakota Law Review, Vol. 54, No. 4, p 589-618, 1978. 1 tab.

Descriptors: *Pollution abatement, *Soil conservation, *Agriculture, *Comprehensive planning, Water pollution sources, Agricultural runoff, Regulation, Erosion, Sediments, Pesticides, Nitrogen, Water quality standards.

After several years of emphasis on point source pollution abatement under the federal Clean Water Act (CWA), gains in improving water quality by abatement of point source pollution alone will be offset by continuing non-point source pollution. Thus, a national shift to control non-point source pollution is underway. Agricultural non-point source pollutants are the principal contaminants. These pollutants include sediment, dissolved salts, nutrients, pesticides, organic matter, and pathogens. For the past four decades, the soil conservation program has been the voluntary adoption of the best land management practices (BMP's). This approach has been futile. A course of action which the federal Environmental Protection Agency (EPA) should take to set up an effective national regulatory program is recommended and set out. Initially, national standards must be impartially determined. Secondly, regulations must be impartially enforced. The EPA may withhold federal assistance for non-compliance. Thirdly, existing federal, state, and local institutions and agencies must be used for implementation and enforcements, particularly the Soil Conservation Service (SCS), Soil and Water Conservation Districts (SWCD's), and the EPA. Fourthly, a productive, viable agricultural economy must be maintained. And finally, the entire cost sharing program must be assessed and carefully formulated. (Horwich-Florida)
W79-07248

PUBLIC BEACHES: A REEVALUATION,
R. H. Zimmerman.
San Diego Law Review, Vol. 15, No. 5, p 1241-61, August, 1978.

Descriptors: *California, *Coasts, *Public access, *Beaches, Access routes, Recreation, Regulation, Zoning, Conservation, Judicial decisions, Land use, Public rights.

The California coastline is a distinct and valuable natural resource. In recent years, the shortage of public recreational beaches there has become critical. The public's right to the use of the water and the foreshore for public purposes is protected by California's Constitution, statutory provision, and the common law trust doctrine. The conflict between the public's need for recreational access to the coast and the private littoral-owner's right to preserve and to protect his property is herein examined. In particular, the California Coastal Act of 1976 is investigated, and its effectiveness in protecting and in enhancing the public's rights in coastline is assessed. Alternative methods of protecting the public's right to the coastline are examined. An examination of the judicial remedies of implied dedication and custom is also included. The existing mechanisms for protecting the public

coastal rights are inadequate. A solution to the problem will be forthcoming only when the legislature and the courts adopt a new attitude toward protection of this limited and valuable resource. (Fortin-Florida)
W79-07249

DIFFUSED SURFACE WATER LAW AS APPLIED IN SOUTH DAKOTA,
J. T. Sveen.
South Dakota Law Review, Vol. 23, No. 3, p 763-785, Summer, 1978.

Descriptors: *Surface waters, *South Dakota, *Water policy, *Damages, Water rights, Land use, Civil law, Common law, Reasonable use, Natural flow doctrine, Adjacent land owners, Adoption of practices.

Diffused surface water is all water that appears upon the ground in a diffused state with no permanent source of supply or regular course of flow and disappears by perculation or evaporation. Diffused surface water usually results from rain or melting snow. Almost any change of use of one's land will alter surface flows and probably result in harm to another's use and enjoyment of nearby land. Three rules pertaining to diffused surface water have developed in the United States: the common enemy rule; the civil law or natural flow rule; and the modern trend toward the reasonable use rule. South Dakota presently distinguishes urban land from rural land in its treatment of diffused surface waters. A modified civil law rule is followed for agricultural lands. The reasonable use doctrine is applied to urban areas. The present discrepancy in the law should be resolved to allow simple and just solution to surface water controversies. The South Dakota Supreme Court should take that final step and apply a common standard to all state drainage problems. (Fortin-Florida)
W79-07250

THE ARIZONA WATER RESOURCES COMMITTEE: AN HISTORICAL PERSPECTIVE,
Arizona Univ., Tucson. School of Renewable Natural Resources; Wisconsin Univ-Madison. Dept. of Landscape Architecture.
H. J. Cortner, and M. P. Berry.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson, Arizona, Arizona Water Commission Report No. 10, p 5-15, (1977), 6 tab, 11 ref. OWRT A-072-ARIZ (2).

Descriptors: *Administrative agencies, *Institutional constraints, *Watershed management, *Water policy, *Water resources development, Vegetation effects, Political aspects, Governmental interrelations, Local governments, State governments, Political constraints, Legal aspects, Interest groups, Alternate planning, Watersheds(Basins), Arizona.

The history, development, organizational resources, public relations and policy objectives of the Arizona Water Resources Committee (AWRC) are analyzed here with speculation as to the committee's future roles and effectiveness. With its main objectives based upon the 1956 Barr report and conclusion that vegetative modification can be one of the most promising methods for increasing water supplies in Arizona, the AWCR has become an important political interest group with a significant impact upon Arizona water policy since its inception in 1957. This analysis of the committee's action, research and public relations programs reveals both positive and negative results, and a great deal of controversy over organization, orientation and representation. As an organized group the committee can be characterized by many of the variables that distinguish groups with potential to gain access to exert influence in governmental decision making. It is concluded that while the AWRC's remarkable successes in many of its research objectives, especially with its Beaver Creek experimental watershed, are indications of its political proficiency, it must be able and willing to make adjustments in its strategies and tactics for achieving its goals and objectives as the political environment continues to change. (Tickes-Arizona)
W79-07256

A PROPOSED WATER RESOURCES CODE OR STATUTE: ARIZONA WATER RESOURCES MANAGEMENT ACT OF 1977,
Arizona Univ., Tuscon. Coll. of Law.
R. E. Clark.
Arizona Law Review, Vol. 19, No. 4, p 719-859, 1977.

Descriptors: *Arizona, *Legislation, *Groundwater resources, *Water management(Applied), Groundwater, Planning, Water supply, State governments, Percolating water, Legal aspects, Natural resources, Conservation.

In Arizona, current uses and projected demands far exceed available water supply. The need is recognized for legislation which will improve water management and allocation and encourage optimal uses and conservation of the limited water supply. Current legislation relates to only 40% of the State's total water supply. The remaining 60% pumped from groundwater sources is not covered by legislation. The 1977 Arizona Water Management Act (AWMA) recognizes that previous and existing laws have given inadequate attention to the development and use of groundwaters either as an independent source or in conjunction with surface waters. The AWMA as proposed is divided into four chapters: (1) Administration and Operation; (2) Permits and Regulation of Uses; (3) Adjudication of Water Rights; and (4) Wells. The draft proposal began in 1975 in a Natural Resources Law seminar. The goal agreed upon in 1975 remained the same: a broad statute that concentrates on past experience and present problems of scarcity and the uneven occurrence and allocation of water. The proposed statute is followed by a lengthy bibliography and a suggested list of statutes that should be repealed. (Ewing-Florida)
W79-07257

A GEOGRAPHICAL ANALYSIS OF TRENDS IN UNITED STATES WATER RIGHTS LAWS (WITH EMPHASIS ON THE SOUTHEASTERN STATES),
Michigan Univ., Ann Arbor. Dept. of Geography.
J. J. May.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 684, Price codes: A08 in paper copy, A01 in microfiche. Masters Thesis, 1977, 171 p, 18 fig, 2 tab.

Descriptors: *Water rights, *Southeast U.S., *Demand, *Environmental effects, Water supply, Legal aspects, Appropriation, Riparian rights, Permits, Judicial decisions, Surface water availability, Regulation.

The southeastern United States has always had abundant water resources, partly because of the relative lack of demand. Today much of this has changed. The South and West combined now have larger populations than the north. The appropriation doctrine has become an integral part of western life. Southern states have analyzed the applicability of the appropriation doctrine to their needs. Only Mississippi has adopted the doctrine. Several other states have adopted a newer system known as the permit system. This system incorporates many appropriation principles, yet is flexible enough to adapt to each state's unique requirements. Southern states have no techniques, laws or procedures which would enable them to regulate riparian water rights. The problem is what will happen to the water laws as more people move south. Precise evaluation of southern water uses and priorities must be researched and reviewed so that the proper changes may be made and growth may continue. An eight page reference is included. (Ewing-Florida)
W79-07258

STRENGTHENING STATE WETLAND REGULATIONS,
Environmental Law Inst., Washington, DC.
J. A. Kusler.
For Sale by the Supt. of Doc., U.S. Government Printing Office, Washington, D.C. 20402, as Stock Number 024-010-00506-8, Report FWS/OBS-78/98, Nov., 1978. 132 p.

Descriptors: *Wetlands, *State governments, *Protection, *Regulation, Legal aspects, Local governments, Ecology, Preservation, Administrative decisions, Standards, Governmental interrelations.

Recognition of the ecological and economic importance of wetlands, combined with accelerated flood losses and water pollution from wetland development, has prompted many states to adopt regulatory programs specifically designed to control coastal or inland wetland use. Other states guide wetland uses as part of broader flood plain, coastal area, scenic and wild river, shoreland, and critical area programs. Additional considerations prompt state programs: (1) wetlands often cross local government jurisdictions, creating problems in local definition and management; (2) wetland water supply is affected by watershed use; watersheds often encompass several jurisdictions; (3) local government often lacks expertise and funds; and (4) control and protection of wetlands is closely linked with traditional State roles of wildlife protection and public rights in navigable waters. State and conjunctive state and local wetland protection efforts are examined. Two versions of a draft statute provide a basis for new wetland protection efforts. Despite the promising start for state programs, most have been only partially implemented. Much remains to be done to protect essential wetland values and prevent losses from floods and other hazards. (Ewing-Florida)
W79-07259

PROTECTING INSTREAM FLOWS UNDER WESTERN WATER LAW - SELECTED PAPERS,
Office of Biological Services, Fort Collins, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 993, Price codes: A04 in paper copy, A01 in microfiche. Instream Flow Information Paper No. 2, September, 1977, 58 p.

Descriptors: *Water law, Watercourses(Legal aspects), *Stream flow, Water resources, Water rights, Legal aspects, Public benefits, Equity, Appropriation.

These papers cover three subjects: (1) opportunities under current western water law for protecting instream flows; (2) the utility of equity law principles for protecting instream flows; (3) the future of western water law for protecting instream flows. There is an appendix which presents a matrix of all strategies for protecting instream flows. This summary of stategies includes direct legislative actions, administrative or agency actions, contractual agreements, planning programs, judicial doctrines and procedures and other strategies and techniques. Article one is composed of a broad overview of those aspects of the appropriation doctrine significant to instream flows preservation, and the problems and possibilities under the doctrine. Article two discusses the impact of equity law in the doctrine, and the possibility of accomodating private rights under the doctrine and the public interest in beneficial use of public resources. Article three explores the future development of the doctrine both in the courts and through governmental regulation and management. Judicial change will be on a case-by-case basis with no comprehensive change. Legislative change entails the problem of paying for the change. (Greene-Florida).
W79-07260

PUBLIC ACCESS TO THE OCEANFRONT BEACHES - A REPORT TO THE GOVERNOR AND LEGISLATURE OF NEW JERSEY (PUBLIC ACCESS TO THE NEW JERSEY OCEANFRONT BEACHES),
New Jersey Beach Access Study Commission, Trenton.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB-274 099, Price codes: A03 in paper copy, A01 in microfiche. Report April, 1977, 12 p, 2 fig, 10 append.

Descriptors: *New Jersey, *Beaches, *Public access, *Seashores, Public lands, Public rights, Legal aspects, Legislation, State governments, Environmental effects, Recreation facilities.

New Jersey's beaches are among the most heavily used in the nation. The Beach Access Study Commission (BASC) studied the feasibility and advisability of providing open access to the state's beaches bordering on the Atlantic Ocean. 'Beaches' include both the dry sand and wet sand areas. Wet sand area is known as Public Trust Land and belongs to the State unless conveyed by a riparian grant. All but a handful of the state's oceanfront municipalities now charge fees for use of public beaches. Continued land development along the oceanfront threatens to block physical and visual access to open beaches. The Public Trust lands along the coast should be readily accessible to all New Jersey citizens. The best way to achieve greater equity in beach access is through local initiative, subject to state overview, rather than by direct state regulation. The BASC's recommendations fall into three broad implementation categories: State legislation, federal actions, and other state administrative actions. Enactment of a comprehensive beach management law and implementation of the other recommendations will assure citizens a meaningful opportunity to enjoy the beaches. (Ewing-Florida)
W79-07261

UNNECESSARY AND HARMFUL LEVELS OF DOMESTIC SEWAGE CHLORINATION SHOULD BE STOPPED,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 288, Price codes: A04 in paper copy, A01 in microfiche. Report to the Congress August 30, 1977, 36 p.

Descriptors: *Chlorination, *Sewage bacteria, *Waste water treatment, *Water quality standards, Waste treatment, Fish toxins, Swimming, Municipal wastes, Disinfection, Environmental effects, Water quality.

Chlorine discharges by municipal sewage treatment plants sometimes exceed levels safe for the aquatic environment. Except the chlorine needed to protect areas of shellfish harvesting, or of unrestricted irrigation with sewage, the public health benefits are minimal from widespread use of sewage chlorination. The federal General Accounting Ofice (GAO) recommends the Environmental Protection Agency: (1) revise its water quality criteria regarding the bacterial standard for swimmable waters, recognize seasonal variations and delineate those circumstances where sewage chlorination is needed to protect public health; (2) include chlorine residual limitations in all National Pollutant Discharge Elimination System Permits for sewage treatment plants and all industrial discharges of chlorinated effluents; (3) lower chlorine residual limitations in powerplant effluents; (4) require regional offices or states to tailor permits to assure the use of chlorine testing and operating equipment which would improve chlorination efficiency; and (5) incorporate rapid, thorough initial mixing and flow-proportional dosage adjustment into new plant construction review criteria. The GAO also recommends that Congress amend the 1972 Federal Water Pollution Control Act Amendments to permit exceptions from the national goal for swimmable waters to recognize those situations where waters are unswimmable for other reasons. (Greene-Florida)
W79-07262

ILLINOIS ENVIRONMENTAL LAW - STATE PRE-EMPTION OF LOCAL GOVERNMENTAL REGULATION OF POLLUTION RELATED ACTIVITIES,
W. L. Niro.
Illinois Bar Journal, Vol. 67, No. 2, p 118-26, October, 1978.

Descriptors: *Illinois, *Local governments, *State governments, *Governmental interrelations, Regulation, Federal government, Pollution abatement, Environment, Governments, Pollutants, Political aspects.

Land, air, water and noise pollution are typical urban environmental problems which have a detrimental impact on a local, regional or interstate scale. Pollution most often transcends political boundaries creating environmental problems over a broad geographical area. Local governments are increasing their sphere of environmental regulation through zoning power or under a broad constitutional grant of home rule power. Conflicts arise between local governments seeking to promote local welfare and state governments seeking to control pollution on a much broader scale. The courts may rule in one of three ways: (1) state preemption of local authority in favor of exclusive state regulation; (2) concurrent state and local authority; or (3) exclusive local authority. Concurrent jurisdiction, when appropriate, could achieve a clean, healthful environment and promote greater local involvement in reducing the particularly acute environmental damage to local areas. This cooperative government scheme is the core of the federal pollution control effort, which effectuates greater involvement at all levels of government. Included is an analysis of several cases dealing with these issues. (Fortin-Florida)
W79-07263

HOW TO COPE WITH THE SAFE DRINKING ACT,
Texas Univ. at Austin. Lyndon B. Johnson School of Public Affairs.
D. J. Eaton, G. A. Rohlick, and B. Lovelace.
Water & Wastes Engineering, Vol. 15, No. 7, p 31-34, 36, 38, July, 1978. 4 tab.

Descriptors: *Potable water, *Federal government, *Water pollution control, *Water purification, Legislation, Administrative agencies, Water pollution treatment, Public health, Water quality, Water quality standards, Water treatment.

The federal Safe Drinking Water Act involves four types of implementation problems. Not only are the roles of different agencies and the rules they must follow uncertain, but one Act may impose harsh consequences on small water suppliers not in compliance with the Act. The meaning of safety and the cost/benefit balance complicate regulation of drinking water contaminants; and finally, the Act does not mention small water suppliers not under its jurisdiction. Federal agency mandates appear to overlap, and consumer reaction is uncertain. Since the ultimate responsibility for improving drinking water rests on local water utilities and their customers, implementation procedures should respond to their needs and concerns. Some small, privately owned water systems, such as those for trailer parks, are included in the Act's coverage and compliance may drive them into bankruptcy. Some water utility managers question whether flourides or nitrates are hazardous, and feel that their removal should not be the sole responsibility of local suppliers. There is disagreement as to whether costs of activated charcoal treatment are balanced by possible reductions in human cancers. (Rule-Florida)
W79-07264

STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION IN THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
Federal Register Vol. 43, No. 100, p 22160-68, May 23, 1978.

Descriptors: *Permits, *Waste disposal, *Federal water pollution control act, *Sewage effluents, Administrative agencies, Administrative decisions, Water pollution, State government, Pollution abatement, Standards, Regulation, Federal government.

This rule revises parts 124 and 125 of federal Environmental Protection Agency (EPA) regulations, and clarifies procedures and criteria the EPA will use to veto issuance of state national pollutant discharge elimination system (NPDES) permits. These changes are necessary to assure national consistency in water pollution control efforts. Any permit issued to a discharger shall apply and assure compliance with effluent standards and limitations of the Clean Water Act (CWA). Any State or interstate agency participating in the NPDES shall transmit copies of proposed permits to the Regional Administrator (RA). The RA may object to the issuance of the permit as being outside the CWA guidelines and requirements upon one or more of seven grounds. The RA shall notify the Director of any objection to the issuance of the permit. Within 90 days of the Director's receipt of the objection, the State, interstate agency or any interested person may request that a public hearing be held on the objection. After the hearing, the RA shall notify the State of its decision to: (1) reaffirm; (2) modify; or (3) withdraw the objection. (Ewing-Florida)
W79-07265

IMPLEMENTATION OF EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT,
Corps of Engineers, Washington, DC.
Federal Register, Vol. 43, No. 101, p 22306-08, May 24, 1978.

Descriptors: *Floodplains, *Regulation, *Administrative agencies, Environmental effects, Federal government, Legislation, Flood control, Conservation, Preservation, Project planning, Legal aspects.

This proposed regulation prescribes policies to be used by the Corps of Engineers in implementing Executive Order 11988 (EO). The objectives of the EO are to avoid the long and short term adverse impacts associated with floodplain occupation and modification and to avoid direct and indirect support of flooplain development wherever a practicable alternative exists. Implementation of the EO necessitates: (1) determining if proposed action is in the base floodplain; (2) determining if there is a practicable alternative to locating the action in the base floodplain; (3) identifying adverse impacts of the action and induced development and identifying losses of natural and beneficial values of the floodplain; (4) determining any practicable alternatives if the action induces development in the base floodplain; (5) determining viable methods to minimize adverse impacts; (6) advising the public if the action will be in the floodplain; (7) recommending the most desirable plan. A finding that an action must be located in a floodplain must be reported. The public is to be involved in floodplain management decisions. Emergency and flood related activities are exempt from the EO. (Ewing-Florida)
W79-07267

THE CLEAN WATER ACT OF 1977 - MODIFICATIONS OF THE MUNICIPAL PROGRAM,
K. M. Hunciker.
The Harvard Environmental Law Review, Vol. 2, p 127-75, 1977.

Descriptors: *Federal water pollution control act, *Water pollution control, *Water purification, *Waste treatment, Federal government, Legislation, Water pollution, Municipal wastes, Technology, Waste water(Pollution), Legal aspects, Administrative decisions.

The 1977 Clean Water Act (CWA) makes a series of corrections to the municipal wastewater treatment program established under the 1972 Federal Water Pollution Control Act Amendments. The 1972 amendments required all municipal point sources to achieve 'secondary treatment' by July 1, 1977 and 'Best Practicable Waste Treatment Technology' (BPWTT) by July 1, 1983. Because of inadequate funding and delays, only 1/3 of the nation's municipalities met the secondary treatment deadline. The CWA extends this deadline to 1983; however, given the unrealistically low levels of funding passed in the CWA, the 1983 deadline will almost certainly not be met. Most likely the 1983

Congress will again be faced with deadline extensions and costly funding needs. The CWA significantly strengthens the role of unconventional technology in the control of municipal water pollution. Increased incentives and requirements for the application of reuse and unconventional technology will have a major impact on municipal programs. The alternative and innovative technology efforts are more successful than the deadline and funding modifications. The benefits obtainable from unconventional technologies warrant passage of the CWA. (Ewing-Florida)
W79-07268

NON-POINT POLLUTION AND ALASKA,
J. T. Tate, Jr.
UCLA - Alaska Law Review, Vol. 7, No. 1, p 169-84, Fall, 1977.

Descriptors: *Water pollution sources, *Water pollution control, *Environmental effects, *Alaska, Pollutant identification, Water pollution effects, Legislation, State governments, State jurisdiction, Federal water pollution control act, Waste water(Pollution).

Non-point source (NPS) pollutants may account for as much as 50 percent of national water quality problems. Originally known as background pollution, there is no statutory definition of NPS pollution due to its diverse origin. The Alaska Department of Environmental Conservation has identified four areas requiring regulation: (1) silviculture; (2) transportation corridors; (3) mining; and (4) urban environment. Construction practices in Alaska must be carefully managed because of the fragile permafrost and virtual impossibility of re-vegetation of areas strippped of tundra cover. Alaska's recent Environmental Conservation Act covers NPS pollution, but fails to give it the attention accorded to point source pollution. Alaska is currently identifying and evaluation NPS pollution in connection with 1972 amendments to the Federal Water Pollution Control Act, which so far has failed to accomplish its purposes. The Environmental Protection Agency attitude has been negative, in contrast to Alaska's commitment to clean waters. If federal funding is withdrawn, Alaska may be forced to take full financial responsibility for its NPS pollution control efforts. (Rule-Florida)
W79-07269

INLAND BOUNDARY DETERMINATIONS FOR COASTAL MANAGEMENT PURPOSES - AN ECOLOGICAL SYSTEMS APPROACH TO REQUIREMENTS OF THE FEDERAL COASTAL ZONE MANAGEMENT ACT OF 1972,
Texas Univ. at Austin.
C. M. Woodruff, Jr., W. L. Longley, and A. E. Reed.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 189-211, 1978. 5 fig, 1 tab.

Descriptors: *Comprehensive planning, *Coastal plains, *Systems analysis, *Water management(Applied), Coasts, Shores, Texas, Decision making, Analysis, Adoption of practices, Non-structural alternatives.

The 1972 federal Coastal Zone Management Act is aimed at coastal zones, including coastal waters and adjacent shorelines, strongly influenced by each other. The zone also extends inland to the extent necessary to control shorelands. Vagueness in the law causes difficulties for coastal states that must delineate coastal zones, and creates a larger problem of consistency among the states. An inland coastal zone boundary may be defined using operational ecological systems, which demonstrates interconnections among various coastal ecological systems. The application of this kind of systems analysis could prevent an arbitrarily established boundary. The federal law defines coastal waters explicitly, but the shorelands definition must be inferred from Section 304-a. However, a biophysical procedure used in the Texas coastal region entails an analysis and delineation of distinctly coastal environment as stated in the law, followed by establishment of the inland coastal zone boundary in a two-step scientific inquiry. First the ecosystems comprising coastal waters and adjacent areas are mapped, then sustaining flows among the systems are charted. Thus the boundary reflects a conceptual mode but is also based on measurable land and water conditions. (Rule-Florida).
W79-07270

THE PUBLIC TRUST DOCTRINE IN NORTH DAKOTA,
D. Negaard.
North Dakota Law Review, Vol. 54, No. 4, p 565-88, 1978.

Descriptors: *Water law, *North Dakota, *Public rights, Common law, Judicial decisions, Water resources, Water rights, Water policy, Public lands, Planning.

A common law concept, the Public Trust Doctrine allows the public, as beneficiates, to protect its interests when the state exceeds restrictions imposed upon it by a property trusteeship dedicated to the public. Public interests are protected by providing the general public access to the courts when a concerned citizen feels the state has exceeded its authority by an improper allocation of a trust resource. Water demand for energy development and domestic usage created by population impacts associated with energy development and domestic usage created by population impacts associated with energy development will undoubtedly cause litigation involving the trust doctrine. Public interest is served when a governmental body, required to represent the public, ignores or reacts arbitrarily regarding the trusteeship terms in which the public has vested property rights. The doctrine can and will provide a minimum standard for review of government action, but is no substitute for careful, detailed planning and manadatory legislative guidelines for wise energy-related development. (Fortin-Florida)
W79-07271

SUPREME COURT REJECTS WATER AS A LOCATABLE MINERAL FOR FEDERAL MINING CLAIMS,
L. Peters.
Natural Resources Journal, Vol. 19, No. 1, p 183-85, January, 1979.

Descriptors: *Mining, *Water rights, *Judicial decisions, Prior appropriation, Federal jurisdiction, Federal-state water rights conflicts, Water resource development, Water law, Water resources, Water use, Water values, Conflicts.

Historically, the western United States has relied on the doctrine of prior appropriation to allocate scarce water resources. Andrus v. Charlestone involved the determination of whether water is a locatable and claimable mineral under federal mining law. The Court unanimously rejected this theory, preventing what would have been a radical departure from traditional western water acquisition rights. Under federal mining law, a citizen can file a claim, possibly obtain a patent, and acquire fee simple title to certain federal lands to extract valuable minerals. The Justices agreed that water was a valuable mineral, but held that water by itself could not support a mining claim. Two overlapping systems for acquiring water rights would create a myriad of problems among water users. If water were recognized as a locatable mineral, a claimant, consistent with federal mining claims rights, could ignore previous water users and deplete all the water from the claim. The decision is a special victory for western states in their fight against federal encroachment upon their natural resources. (Fortin-Florida)
W79-07272

WATER USE REGULATION IN COLORADO: THE CONSTITUTIONAL LIMITATIONS,
H. Gottschalk.
Colorado University Law Review, Vol. 49, p 493-512, Summer, 1978.

Descriptors: *Colorado, *Constitutional law, *Regulation, *Water rights, Prior appropriation, Invasion, Water utilization, Public benefits, Constitutional law, Legislation, Municipal water.

In Colorado, state regulation of private water use has traditionally been limited to waste prevention. However, political and legal pressure is prodding the state to increase control of private water use. Several bills have recently been proposed to regulate water use. One such bill provides that any change of a water right from an agricultural to another type of use would result in the loss of the right's original priority date. Another bill requires that any transmountain diversions of water must be approved in a state-wide election. Both bills would restrict the free alienability of water rights, decreasing their value, and, prevent any increase in municipal water supplies, thus curtailing the availability of housing to all those desiring to live in Colorado. These limitations will thus likely be challenged on three constitutional grounds: (1) they constitute a taking of private property; (2) they are not enacted for the benefit of the public welfare; (3) they violate the right to travel. In analyzing the constitutional limitations of these regulations, case law, policy, and other constitutional issues are examined. It is concluded that the proponents of the regulations will have great difficulty in sustaining their validity. (Horwich-Florida)
W79-07273

AN ALTERNATIVE PERSPECTIVE ON COMMON PROPERTY RESOURCE ALLOCATION DECISIONS IN THE COASTAL ZONE,
Texas A and M Univ., College Station.
G. C. Swanson, J. L. Seymour, and R. B. Ditton.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 25-43, 1978. 1 fig, 1 tab.

Descriptors: *Shore protection, *Water management(Applied), *Comprehensive planning, *Wetlands, Shore, Coastal marshes, Seashores, Tidal marshes, Beaches, Economics, Coasts.

Failure to allocate coastal resources, as well as their improper utilization stems from the fact that no adequate basis currently exists to define the correct relationship and division of labor between public and private sectors. Thus, instead of considering consumer utility as the criterion of effectiveness of an agency, performance is assessed on the basis of producer efficiency. Historically, this results from a lack of conceptual clarity regarding differences between public and private goods and services, causing resource allocation decisions to be assigned to the public or private sector without regard to that sector's strengths or weaknesses in dealing with the allocation decision. Coastal property involves both public and private interests. Beaches and shorelands protection could be based on property interests rather than regulation. Artificial reefs, usually constructed by state fish and wildlife departments and local municipalities, could be financed by private enterpreneurs if they could have a property right in the resultant fishing areas. Coastal wetlands and marshlands, a great percentage of which are privately owned, could be treated as subject to a public servitude, with compensation to owners for the public's indirect use. (Rule-Florida)
W79-07274

THE FEDERAL REGULATORY ROLE IN COASTAL LAND MANAGEMENT,
Bates Coll. of Law, Houston, TX.
G. L. Finnell, Jr.
American Bar Foundation Research Journal, Vol. 1978, No. 2, p 169-288, Spring, 1978.

Descriptors: *Federal-state water rights conflict, *Federal jurisdiction, *Coasts, Conservation, Federal government, State governments, Environmental control, Marshes, Federal water pollution control act, Rivers and harbors act, Clean air act.

Historically, the federal government has had a major role in regulation of coastal activities, primarily restricted until recently, to regulation of

activities affecting navigable waters. On the sea coast, regulation of landward areas of such jurisdictional boundaries as mean high tide line was generally left to the states or their delegates. Recently, the federal role, both direct and indirect has increased dramatically. If states fail to respond adequately to important regulatory needs, our federal constitution permits expansion of federal power to fill the void. For coastal land management, the most important source of federal jurisdiction is the power to regulate commerce...among the states. The most important source of state jurisdiction is the police power. Coastal regulatory programs should consider all competing values. Analysis should address at least the following categories: (1) the relationships of environmental, economic and social values; (2) the relationship of the individual property owner to government; (3) intergovernmental relationships; (4) the relationship and functioning of the political and legal processes; and (5) practical considerations. (Fortin-Florida)
W79-07275

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
F. J. MacDowell.
Natural Resources Journal, Vol. 19, No. 1, p 191-96, January, 1979.

Descriptors: *Water policy, *Water resources, *Administrative decisions, Water supply, Water structure, Water conservation, Administration, Administrative costs, Political aspects, Environmental effects, Conservation.

President Carter has set out several major objectives in his 1978 Water Policy Initiatives: (1) making water projects more economically sound; (2) stressing water conservation: (3) improving federal-state cooperation; and (4) focusing more attention on environmental quality. Set forth are his criteria for selection of projects that he would approve. The criteria are designed to relate policy objectives to the budget process, and to inform Congress and the public of what his selection process entails. Federal agencies involved with water resources are obviously affected by Carter's policy and its ramifications. Concern exists because individual states, especially western states, like to exercise exclusive control over their water. Probably all of the objectives can be furthered in some ways. The policy contains necessary improvements in the water resources area. Some of the directives are general and leave much discretion in individual agencies. The risk exists that agencies will implement only the minimum requirements and leave unsolved the most important problems. This might be especially true in the western states, where Carter's opposition to water projects has aroused hostility. (Fortin-Florida)
W79-07276

COASTAL LAND MANAGEMENT: AN INTRODUCTION,
Bates Coll. of Law, Houston, TX.
G. L. Finnell, Jr.
American Bar Foundation Research Journal, Vol. 1978, No. 2, p 153-67, Spring, 1978.

Descriptors: *Coasts, *Land management, *Governmental interrelations, *Planning, Federal government, State governments, Water rights, Beaches, Local governments, Long term planning, Zoning.

During the 1970's, the coastal zone-that ecologically unique area where sea and land meet and strongly influence each other - has become a principle laboratory for experiments in new land management techniques. Disputes over coastal land use raise important questions as to the interaction between the individual and government, and the interrelationships among local, state and national governments. Although the federal government has always had a major role in regulation of coastal activities, until recently, this role was restricted mainly to regulation of activities affecting navigable waters. Today, the trend in coastal land management is not toward federal preemption of state and local authority, but toward 'cooperative federalism'. State legislatures must take the lead in designing coastal land management programs. A state's coastal land planning process should be coordinated, to the maximum degree feasible, with other state programs for transportation, energy, and water resource planning. State and local governments that resist the enactment and implementation of concurrent and cooperative regulatory programs are probably doing their citizens a serious disservice. (Fortin-Florida)
W79-07277

PORT STATE JURISDICTION OVER VESSEL - SOURCE MARINE POLLUTION,
Coast Guard, Washington, DC. Office of the Chief Counsel.
R. A. Legatski.
Harvard Environmental Law Review, Vol. 2, p 448-73, 1978.

Descriptors: *Port authorities, *International law, *Political constraints, *Water pollution control, Ships, State jurisdiction, Legal aspects, Standards, Economic impact, Water rights.

Port state jurisdiction over vessel-source marine pollution may provide a reasonable balance between the need to protect the ocean environment and the sometime conflicting need to avoid imposing excessive costs on ocean-going commerce. As formulated in the Informal Composite Negotiating Text (ICNT) from the Law of the Sea Conference, port states would have no special competence to prescribe vessel-source pollution control standards. They would play a significant role in the enforcement of standards prescribed by flag and coastal states and international agreements. Several conditions are necessary to the development of a port state regime that both controls vessel-source pollution and restricts unilateral coastal state jurisdictional assertions: (1) broadly accepted uniform international standards; (2) adequate standards to protect the coastal state's environmental interests, like the 'special area' standards of the ICNT; and (3) assurances to coastal states that other states will actively protect against ocean pollution. Possible impediments to the development of international standards are the proposed Tanker and Vessel Safety and Clean Water Acts. The United States should not interpret these acts to authorize implementation of standards significantly not variance with those accepted by other states. (Greene-Florida)
W79-07278

INSUFFICIENT EIS HALTS HYDRO-ELECTRIC PROJECT,
A. T. Lorenz.
Natural Resources Journal, Vol. 18, No. 2, p 403-07, April, 1978.

Descriptors: *Hydroelectric plants, *Power plants, *New Mexico, *Environmental effects, *Dams, Federal government, Judicial decisions, Engineering structures, Fish conservation, Wildlife conservation, Project planning.

In 1973 the federal Bureau of Reclamation began construction on a 23-megawatt powerplant in the Navajo Dam and Reservoir on the San Juan River in New Mexico. As originally authorized by Congress in 1956, the powerplant was to produce 15-megawatts of electricity for use in a gravity-flow irrigation system. Instead, the plant was designed for an all-sprinkler system. In 1976, the National Wildlife Federation and the New Mexico Wildlife Federation brought action to halt construction because the resultant fluctuations in water volume and flow rate would harm fish and wildlife. The District of Columbia District Court found that since the powerplant was not proposed until 1973, it could not have been implicitly authorized earlier, and that defendant's failure to prepare a detailed environmental impact statement prevented compliance with the National Environmental Policy Act of 1969. This failure, and the Secretary of the Interior's failure to report to Congress concerning the stream modification, violated the Fish and Wildlife Coordination Act. Thus, the power that would have been created by a non-polluting renewable source must be replaced using fossil fuels. (Rule-Florida)
W79-07279

CONSERVATION AND DEVELOPMENT IN OREGON'S COASTAL ZONE,
A. Levinson, and J. Hess.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 97-114, 1978. 1 fig, 2 tab.

Descriptors: *Coasts, *Shore protection, *Comprehensive planning, *Oregon, Shores, Decision making, Water management(Applied), Planning, Management, Permits, Land use, Land management.

Coastal zone management in Oregon, based on the state's general land-use law, covers a coast of 352 miles, or 7811 square miles of land. The shoreline was designated as a public highway in 1913. Later, the state's 1969 Beach Bill declared public easement rights to the ocean shore up to the vegetation line. In 1971, bills were passed requiring a permit prior to filling any of Oregon's waters, and controlling silting and debris in streams and estuaries. Also in 1971, the Oregon Coastal Conservation and Development Commission was established in an attempt to coordinate the coastal management program. Later the Commission was absorbed into the Land Conservation and Development Commission (LCDC) which developed final goals and guidelines for compliance with the federal Coastal Zone Management Act. Other state laws and agencies continue to have an impact in planning for coastal zone land and water use. The goals developed by the LCDC were refined and adopted by the state legislature in 1976, and now constitute the key to Oregon's coastal zone management program, which is now undergoing federal review. (Rule-Florida)
W79-07280

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

HIGHTIDE - A COASTAL COMMISSIONER'S PERSPECTIVE: CHOOSING BETWEEN WHAT THE LAW SAYS AND WHAT THE LAW ALLOWS,
J. B. Rosener.
Coastal Zone Management Journal, Vol. 4, No. 1-2, p 1-5, 1978.

Descriptors: *Decision-making, *Political aspects, *Coasts, *Land development, Land use, Local governments, Permits, Construction, Administrative agencies, Planning, Environmental effects.

Observations are presented of the role of a coastal commissioner. It is suggested that the role carries with it both implementation and policymaking functions which require the exercise of discretionary authority. The main task of regional commissions was to control coastal development. People who wished to develop within the permit zone were required to obtain permits from a regional commission before they could build. Public hearings were held on every permit application. The commission had veto power over the local government and the law was vague as to how criteria for the denial of development permit applications should be applied. The Commission deliberations were open, visible and unlike other regulatory bodies' meetings. Commissions were under constant scrutiny by citizens and legislators. It was discovered that what was adverse, what was environmental, and what constituted an impact, called for discretionary judgements. It was found that certain kinds of skills were needed in order to resolve the conflicts between public and private interests. The tug of war between what the law said and what the law allowed provided the framework within which commissioners functioned, which was that of both 'implementer' and 'policy maker.' (Fortin-Florida)

W79-07282

PUBLIC ACCESS TO THE SHORELINE: THE RHODE ISLAND EXAMPLE,
Rhode Island Univ., Kingston.
D. Nixon.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 65-79, 1978.

Descriptors: *Rhode Island, *Shores, *Public access, *Public rights, Common law, Coasts, Easements, Right-of-way, Federal government, Legal aspects, Long term planning, Public rights.

The issue of public access to the Rhode Island shoreline is considered at three levels: (1) common law doctrines of the public trust, dedication, easement by prescription, and custom; (2) federal impact through the 1972 Coastal Zone Management Act (CZMA); and (3) state management programs. The Rhode Island example presents a variety of potential alternatives to pursue to increase public access. The common law remedies, though complex and manageable only on a case-by-case basis, may be used by a member of the public to protect access rights. The federal government, through the CZMA, regards the access issue as one of many uses that must be permitted and encouraged along the shoreline. Program management and acquisition funds are reserved for states that plan according to federal guidelines. Examination of state programs has demonstrated the problems in discovering and maintaining individual rights-of-way and in developing management programs to ensure continued success. The diversity of levels by which to approach the access problem under this example can only help provide a steady increase in access to the Rhode Island shoreline. (Ewing-Florida)
W79-07283

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA: 303(E) BASIN PLAN FOR THE RED RIVER OF THE NORTH RIVER BASIN,
South Dakota Dept. of Environmental Protection, Pierre.
For primary bibliographic entry see Field 5G.
W79-07380

COMPREHENSIVE WATER QUALITY MANAGEMENT FOR THE STATE OF SOUTH DAKOTA. 303(E) BASIN PLAN FOR THE CHEYENNE RIVER BASIN 08SD0700,
South Dakota Dept. of Environmental Protection, Pierre.
For primary bibliographic entry see Field 5G.
W79-07382

FEASIBILITY OF A SYSTEMATIC APPROACH TO WATER QUALITY MANAGEMENT IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 5G.
W79-07384

SUBURBAN DRAINAGE,
Ohio Legislative Service Commission, Columbus.
For primary bibliographic entry see Field 4A.
W79-07385

PROCEEDINGS, NORTH CAROLINA WORKSHOP ON MANAGEMENT OF STORMWATER, SEDIMENTATION AND FLOOD CONTROL IN URBAN AREAS,
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W79-07389

BENEFITS AND COST OF SEASONAL EFFLUENT PERMITS IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
For primary bibliographic entry see Field 5B.
W79-07419

6F. Nonstructural Alternatives

MEASURING PREFERENCES FOR NATURAL LANDSCAPES,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
J. A. Dearinger.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. UP1, p 63-80, January 1979. 5 fig, 6 tab, 31 ref. OWRT B-015-KY(3). 14-31-0001-3086.

Descriptors: Natural resources, *Recreational facilities, Streams, Attitudes, *Esthetics, Human behavior, Land use, Urban development, Zoning, Preferences, Multivariate data, Factor analysis, Regression analysis.

In land-use planning, decisions must often be made concerning the preservation or development of natural landscapes. The research described herein sought a way to measure these preferences. Subsets of 95 photographic color slides portraying varying degrees of naturalness were shown to 14 assorted groups of people (371 persons in all). Preferences were quantified using a semantic differential scale made up of 20 bi-polar adjective pairs. The results were factor analyzed for each group and three factors identified: Scenic Beauty, Natural Force, and Starkness. Factor scores were computed for each scene and group and for selected individuals. Some conclusions were: (1) the procedure yields a usable measure of preference which varies with the subject's familiarity with the scene, his or her occupation, and the life style; (2) scenes that include moving water are preferred over those with still water or no water; (3) naturally barren areas are seldom perceived as beautiful by most people; and (4) people tend to agree on what is very beautiful or very ugly but disagree on the in-between. (Bell Graf-Cornell)
W79-07125

SURVEY AND EVALUATION OF SOCIAL SCIENCE RESEARCH ON FLOOD-DAMAGE ABATEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
S. K. Paulson, and W. E. Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 638, Price codes: A06 in paper copy, A01 in microfiche. VA Water Resources Research Center VA Polytechnic Inst. and State Univ. B-114 Jun 79. 99 p, 19 tab, 169 ref, 2 append. OWRT A-074-VA(1).

Descriptors: Floods, *Flood damage, Institutions, Values, Attitudes, Bibliography, Economics, *Non-structural alternatives, Social aspects, Flood prevention.

Scientists--particularly engineers, biologists, geologists, and economists--continue to research ways of preventing damage to life and property from the flooding of lakes, rivers, and streams. As a result of such efforts, a variety of effective structural and non-structural flood-damage reduction methods have been developed. The human social aspects of such methods, however, have not been researched as extensively. This study documented the nature and extent of existing social science literature in this area and identified future research needs through six data collection efforts. Two types of information were compiled: social science research conducted to date and knowledgeable persons' perceptions of needed research. A bibliography of the most relevant extant materials was constructed, and the contents of each entry were analyzed. Results of this study indicate that most research on flood-damage reduction has focused on the economic and engineering aspects of the structural methods of damming and channeling and has been of the sponsored, case-study type of design. The sociological aspects of non-structural methods have received minor emphasis. Recommendations advocate additional research in the area of non-structural flood-damage reduction methods, focusing on such variables as the social attitudes, beliefs, and behavior of individuals, and social and political structure of communities.
W79-07130

STRENGTHENING STATE WETLAND REGULATIONS,
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07259

IMPLEMENTATION OF EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07267

THE PUBLIC TRUST DOCTRINE IN NORTH DAKOTA,
For primary bibliographic entry see Field 6E.
W79-07271

AN ALTERNATIVE PERSPECTIVE ON COMMON PROPERTY RESOURCE ALLOCATION DECISIONS IN THE COASTAL ZONE,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 6E.
W79-07274

COASTAL LAND MANAGEMENT: AN INTRODUCTION,
Bates Coll. of Law, Houston, TX.
For primary bibliographic entry see Field 6E.
W79-07277

6G. Ecologic Impact Of Water Development

NATIONAL WILDLIFE FEDERATION INTERIM SURVEY OF EPA 201 WASTEWATER TREATMENT FACILITY GRANT PROGRAM DOCUMENTS LAND USE IMPACTS, NEPA COMPLIANCE AND PUBLIC PARTICIPATION (JANUARY 1-MARCH 31, 1976,
National Wildlife Federation, Washington, DC.
J. M. Lishman, and T. K. Bick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 640, Price codes: A11 in paper copy, A01 in microfiche. Report, 1977. 244 p, 2 tab.

Descriptors: *Evaluation, *Administrative agencies, *Federal government, *Environmental effects, *Waste water treatment, Land use.

A four-part analysis is presented of EPA performance, region by region, on land use impacts, compliance with legal requirements, and public participation in the 201 waste water treatment facility grants program. Regions 7 and 10 were the only regions consistently sending hearing notices to the Federation. Negative declarations in EIS's are thorough for Regions 2 and 10. Regions 3, 6, and 8 indicate impacts on environmentally sensitive resources such as wetlands, wildlife habitat, and flood plains, but the information provided is generally insufficient. Declarations of other regions are inadequate. The environmental appraisals of Region 2 and 10 are rated best, while Region 1, 3, 6, and 8 also mention secondary effects. Appraisals of Regions 5 and 7 failed to explore any primary or secondary impacts. Only two draft EIS were received. (Small-FRC)
W79-07052

DRAFT ENVIRONMENTAL IMPACT STATEMENT: GREENSBORO-GUILFORD COUNTY, NORTH CAROLINA, 201 WASTEWATER TREATMENT SYSTEM, EPA PROJECT NOS. C37037601, C37036901.
Environmental Protection Agency, Atlanta, GA. Region IV.

For primary bibliographic entry see Field 5D.
W79-07053

DRAFT ENVIRONMENTAL IMPACT STATEMENT, CITY OF JACKSONVILLE, FLORIDA, WASTEWATER MANAGEMENT FACILITIES, ARLINGTON-EAST SERVICE DISTRICT.
Environmental Protection Agency, Atlanta, GA. Region IV.
For primary bibliographic entry see Field 5D.
W79-07066

THE JUVENILE FISH POPULATION IN THE MARGINAL AREAS OF THE HENDRIK VERWOERD DAM,
Cape Town Dept. of Nature and Environmental Conservation, Van der Kloofdam (South Africa). Rolfontein Nature Conservation Station.
J. A. Cambray, S. Hahndiek, and Q. Hahndiek.
Journal of the Limnological Society of Southern Africa, Vol. 4, No. 1, p 21-30, July 1978. 6 fig, 6 tab, 8 ref.

Descriptors: *Aquatic habitats, *Impounded waters, *Juvenile fish, *Fry, *Fish populations, Sampling, Equipment, Nets, Ecosystems, Ecology, Dams, Fish passages, Marginal utility, Verwoerd Dam, Orange River, South Africa.

Fish were sampled from a variety of habitats around the 350 km shoreline of the Hendrik Verwoerd Dam to determine which juvenile and small fish species are utilizing the marginal areas, to note the frequency of the species in different habitats, and to ascertain what length groups are using the areas sampled. Small seine nets were used in intensive three week surveys over two consecutive years during April when all fish species had bred and water temperatures were still high enough to attract juveniles into the shallows. To obtain a sample of fish from a given area other than by netting several areas were sectioned off from the dam and a pisicide was applied. A total of 6,848 fish were collected at 81 locations during the 1976 survey; 7,615 fish were collected during the 1977 survey at 113 sites. The length and composition of six identified species are discussed and correlated to habitat types. The results of the surveys indicate that inflowing spruits, sheltered areas in eroded gullies, and flooded vegetation are the important nursery areas in the dam. (Davison-IPA)
W79-07184

ON THE DISSOLVED SOLIDS OF THE PONGOLO FLOOD PLAIN PANS,
Natal University, Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 4A.
W79-07187

IMPROVEMENTS NEEDED BY THE WATER RESOURCES COUNCIL AND RIVER BASIN COMMISSIONS TO ACHIEVE THE OBJECTIVES OF THE WATER RESOURCES PLANNING ACT OF 1965,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07233

WETLAND PROTECTION IN COMPLIANCE WITH NEPA,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07238

DREDGING AMERICA'S WATERWAYS AND HARBORS--MORE INFORMATION NEEDED ON ENVIRONMENTAL AND ECONOMIC ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07242

UNNECESSARY AND HARMFUL LEVELS OF DOMESTIC SEWAGE CHLORINATION SHOULD BE STOPPED,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07262

IMPLEMENTATION OF EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07267

HIGH-MOLECULAR-WEIGHT HYDROCARBONS IN ZOOPLANKTON, SEDIMENT AND WATER: TOTAL ORGANIC CARBON AND DELTA C13 IN SEDIMENT: SUMMARY OF HIGH-MOLECULAR-WEIGHT HYDROCARBON ANALYSES CARRIED OUT IN SUPPORT OF THE MICROBIOLOGY PROJECT AND THE TOPO-HIGH PROGRAM,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5B.
W79-07291

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION I,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07372

POTENTIAL FLOOD DAMAGES, WILLAMETTE RIVER SYSTEM, SECTION II,
CH2M/Hill, Portland, OR.
For primary bibliographic entry see Field 2E.
W79-07373

7. RESOURCES DATA

7A. Network Design

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
For primary bibliographic entry see Field 6B.
W79-07063

WASTEWATER SAMPLING METHODOLOGIES AND FLOW MEASUREMENT TECHNIQUES,
Environmental Protection Agency, Kansas City, MO. Region VII.
D. J. Harris, and W. J. Keffer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 875, Price codes: A07 in paper copy, A01 in microfiche. Report EPA 907/9-74-005, 1974. 125 p, 3 fig, 19 tab, 13 ref, 1 append.

Descriptors: *Sampling, *Measurement, *Analytical techniques, *Chemical analysis, *Data collections, Instrumentation, Monitoring, On-site data collections, Research equipment, Treatment plants, Waste water treatment, Water pollution control, Municipal wastes.

Thirteen brands of commercially available automatic waste water samplers were evaluated and tested under field conditions over a 1 yr period by the Field Investigations Section of the EPA. Waste water samples collected simultaneously with different automatic compositors and manual sampling methods demonstrated significantly different waste water chemistries during five separate sampler performance studies. A comparison of waste water samples collected with high vacuum samplers, slower acting samplers, and manual techniques indicated that high vacuum samplers collected concentrations of nonfilterable solids which were sometimes two- to three-fold those levels obtained by other sampling methods. The minimum variations in solids data, attributed to differences in samplers and collection techniques, ranged from 9-24%. Hydraulic measurement methods utilized in waste water sampling activities were also evaluated and incorporated weirs, flumes, recording equipment, wet well volume displacement, flow rates in pipes, and open channel flow. The precision of three individual flow measurements was found to be approximately 10%. (Lisk-FRC)
W79-07076

ECOSYSTEM ANALYSIS FOR WATERSHED MANAGEMENT,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.; and Arizona Univ., Tucson.
D. R. Carder, F. R. Larson, J. J. Rogers, W. O. Rasmussen, and P. F. Ffolliott.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson, Arizona. Arizona Water Commission Report No. 10, p 22-25 (1977). 1 fig.

Descriptors: *Model studies, *Simulation analysis, *Watershed management, *Systems analysis, *Water resources planning, Analytical techniques, Hydrologic data, Forecasting, Future planning, Forest management, Evaluation, Multiple-purpose projects, Arizona.

Land management practices are facing the dual need to exploit forest commodities and to provide recreational areas within those same forests at the same time. The multiresource management research program at Flagstaff, Arizona, known as the Beaver Creek Program, has been designed to simulate multiple-use management of forest watersheds through model computer studies known as ECOSIM, for Ecosystem Component Simulation Models. Its components include water, flora, and fauna. The designers of this program believe that inputs of water, sediment, and non-point source pollutants to a river system from a managed tributary watershed cannot be predicted or controlled effectively without dealing with the ecosystem as a whole, and they have, therefore, provided in their model estimates for sediment yields as well as nitrogen, phosphorus, thermal energy, and dissolved oxygen, both annually and for single storm events. The major climatic events and the actions of man that affect the three basic components will be represented by several additional groups of inter-active modules as the prototype version becomes operational. Trial applications of the ECOSIM prototype are expected to demonstrate the technological feasibility of developing a widely applicable easily usable system that will provide a substantially better basis for making forest-watershed management decisions when combined with professional experience and the viewpoints of concerned citizens. (Parlore-Arizona)
W79-07123

SIMULATION OF THE URBAN RUNOFF PROCESS,
Snowy Mountains Engineering Corp., Canberra (Australia).
For primary bibliographic entry see Field 6A.
W79-07376

BETTER GUIDANCE AND CONTROLS ARE NEEDED TO IMPROVE FEDERAL SURVEYS OF ATTITUDES AND OPINIONS.
Comptroller General of the United States, Washington, DC.
September 15, 1978. 76 p, 9 append.

Descriptors: *Data collections, *Surveys, *Information exchange, *Sampling, *Federal Government, *Federal Reports Act, Census, Statistics, Research priorities, Administrative agencies, Public opinion, Data analysis, Questionnaires, Polls.

This report reviews Federal survey techniques and offers recommendations to Federal agencies so that they can better utilize surveys and polls to gain valuable public and technical opinion input. The report first describes the Federal Reports Act which governs federal information collection activities and then defines the scope of review. The six Federal agencies reviewed are the Departments of Commerce, Defense, Transportation, Interior, State, and the Federal Energy Administration

(FEA). The report identifies polls and surveys conducted by these agencies and examines five surveys in detail. These surveys include three opinion polls in the Dept. of Commerce called Project Feedback, one in the Transportation Dept. called Concorde Community Response, and one in the FEA entitled A Marketing Approach to Carpool Demand Analysis. These case studies are illustrated by charts and an in-depth critiquing of their methods is offered. Most of the 209 attitude surveys and public opinion polls utilized by Federal agencies were performed by contractors. The lack of statistical and survey expertise was a major problem for many federal agencies. Because of this lack of expertise, the agencies need detailed guidance and standards to familiarize them with potential problems. This guidance has been lacking from OMB which sets the standards for federal agencies in information gathering activities. The appendices list the titles of public opinion poll and attitude survey questionnaires used at the six Federal agencies and letters from directors of the information gathering departments in these agencies. (Coan-NC)
W79-07377

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 5. GENERAL GEOLOGY AND SEISMICITY,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 2F.
W79-07386

7B. Data Acquisition

LABORATORY AND PILOT PLANT EVALUATION OF INTERMITTENT LOADING ON SMALL-SCALE EXTENDED AERATION BIOLOGICAL SYSTEMS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5D.
W79-07039

ELECTROMETRIC DETERMINATION OF METALS IN WASTE WATERS CONTAINING SURFACTANTS: SUITABILITY OF DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY OF AN HANGING MERCURY DROP ELECTRODE,
George Washington Univ., Washington, DC. Dept. of Chemistry.
T. A. Getek, and W. E. Schmidt.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 287, Price codes: A05 in paper copy, A01 in microfiche. Report, 1978. 67 p, 9 fig, 17 tab, 211 ref.

Descriptors: *Electrodes, *Analytic techniques, *Metals, *Waste water(Pollution), *Electrochemistry, Zinc, Copper, Cadmium, Lead, Surfactants, Adsorption, Performance.

The effects of organic constituents on the electrometric determination of metals in waste waters were investigated. The primary electrometric method studied was differential pulse anodic stripping voltammetry. The three parts of the investigation included: Intermetallic compound formation of zinc and copper using differential pulse anodic stripping and voltammetry with a hanging mercury drop electrode; Effects of organic surface activating substances on differential pulse anodic stripping voltametry; And, review of the use of anodic stripping voltammetry for trace analysis. In the first part, a study was made of the limiting concentrations at which an intermetallic compound has an adverse effect on the calibration of zinc and copper at a hanging drop electrode in the differential pulse mode. In the second part, the interference of surface activating substances was investigated to eliminate the surfactants if necessary. An adsorptive technique was suggested for trace measurements in ideal samples. In part three, a comprehensive review of the literature was undertaken to compile information on the applicability of differential pulse anodic stripping voltammetry to the determination of zinc, cadmium, lead, and copper waste water. Stripping analysis, interferences, applicability and reproducibility, and purification are considered. (Small-FRC)
W79-07049

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
For primary bibliographic entry see Field 6B.
W79-07063

WASTEWATER SAMPLING METHODOLOGIES AND FLOW MEASUREMENT TECHNIQUES,
Environmental Protection Agency, Kansas City, MO. Region VII.
For primary bibliographic entry see Field 7A.
W79-07076

ACCURACY OF IMPERVIOUS AREA VALUES ESTIMATED USING REMOTELY SENSED DATA,
Science and Education Administration, Beltsville, MD. Hydrology Lab.
T. J. Jackson, and R. H. McCuen.
Water Resources Bulletin, Vol. 15, No. 2, p 436-446, April 1979. 5 fig, 1 tab, 6 ref.

Descriptors: *Remote sensing, *Hydrologic data, *Model studies, Satellites(Artificial), Land use, Vegetation, Classification, Sampling, Data collections, Data processing, Analytical techniques, Hydrology, LANDSAT.

Remote sensing offers an attractive alternative to conventional data collection employed in the estimation of certain hydrologic model parameters. In this investigation, the standard error of parameters estimated from Landsat data was examined. Relationships between the standard error and the size of the spatial-modeling units were developed that allow extending results to larger areas. Based upon the investigations conducted, a generalized model of the error relationships could not be developed. (Sims-ISWS)
W79-07119

LIGHTWEIGHT CORER DESIGNED FOR SAMPLING VERY SOFT SEDIMENTS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W79-07134

DRAINAGE WATER SAMPLING IN A WET, DUAL-PORE SOIL SYSTEM,
Centre County Planning Commission, Bellefonte, PA.
For primary bibliographic entry see Field 2G.
W79-07153

RAPID RESPONSE TENSIOMETER FOR EVALUATING PREPLANT IRRIGATION EFFICIENCY,
C. W. Wendt, and H. P. Harbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 897, Price codes: A04 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University, College Station. Technical Report No. 102, April 1979. 70 p, 12 fig, 23 fig, 16 ref, 1 append. OWRT C-7642(7252)(2).

Descriptors: *Tensiometers, *Irrigation efficiency, *Irrigation practices, Irrigation design, Soil moisture, Soil physical properties, Soil moisture meters, Instrumentation, Soil types, Soil water, Infiltration, Water utilization, Clay loam, Infiltration rates, Nuclear moisture meters, Lubbock(Texas), Halfway(Texas).

A study was undertaken to determine whether rapid response tensiometers can be used to evaluate, reliably and conveniently, the efficiency of preplant irrigation. Study sites were an Oltan loam soil at Lubbock and a Pullman clay loam at Halfway in Texas. Both portable rapid response and permanently installed tensiometers were used to measure soil water potential; a neutron probe measured the soil water content. A methonal-water mixture was substituted for the water in the permanent tensiometers to keep them from freezing. The problems encountered after the rapid response tensiometers were installed, cracked bulbs and clogging of the pores of the bulbs with soil and clay, resulted in slow response time and inaccurate readings. When the rapid response tensiometers were working properly the readings obtained compared favorably with those from the permanent tensiometers. The permanently installed tensiometer and the neutron soil moisture probe yielded good data for evaluating the efficiency of preplant irrigation from furrow irrigation. Application efficiencies ranged from the water source, flow rate, content. Small amounts applied to dry soils at fast flow rates were generally the most efficient applications. (Davison-IPA)
W79-07168

NATIONAL INVENTORY OF MUNICIPAL WATERWORKS AND WASTEWATER SYSTEMS IN CANADA 1977.
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
1977. 339 p, 2 app.

Descriptors: *Census, *Cities, *Municipal water, *Water sources, *Water works, Wastewater treatment, Waste water disposal, Data collections, Indexing, Canada, *National inventory, *Questionnaires.

In 1974, the provincial and federal governments, in cooperation with the Federation of Associations on the Canadian Environment undertook a major inventory of municipal water and wastewater services in Canada. The results of this work were published as the 'National Inventory of Municipal Waterworks and Wastewater Systems in Canada - 1975'. In order to maintain this comprehensive and verified data source an update of the inventory was completed in early 1978 and a summary of this update is provided. (WATDOC)
W79-07211

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
J. C. Jones, and M. P. Lynch.
Coastal Zone Management Journal, Vol. 4, No. 1-2, p 127-49, 1978.

Descriptors: *Virginia, *Coastal marshes, *Land development, *Wetlands, Coasts, Water conservation, Regulation, Planning, Local governments, Legislation, Permits.

The Virginia Wetlands Act of 1972 provides the localities of Tidewater, Virginia--cities counties and towns, which interact most directly with the wetlands of the state--an opportunity to participate in the management of the state's coastal wetlands resources. This study attempts to analyze the effectiveness of this legislation and to examine the implications of local management scheme for coastal resource management on a broader scale. Criteria are established that can be used to evaluate the effectiveness of such a law. When examined in the light of these criteria, the Virginia Wetlands Act emerges, for the most part as an effective piece of environmental quality legislation that has had a significant impact on wetlands destruction in the state of Virginia. During the two year period following the passage of the Act, wetlands losses through the permitting process showed an 18-fold decrease from previous estimate. The Wetlands Act appears to have been generally accepted by the public and has resulted in consistently uniform decisions, which have reduced wetland losses without unduly restricting the necessary and legiti-

mate development of the states wetlands. (Fortin-Florida)
W79-07281

SOLVE LINEAR PROPORTIONAL WEIR DESIGN QUICKLY,
Indian Inst. of Tech., Bombay.
B. S. Pani, and A. S. Ramurthy.
Water and Wastes Engineering, Vol. 16, No. 1, p 50-53, January 1979. 7 fig, 2 tab, 1 ref.

Descriptors: *Weirs, *Design, *Hydraulic design, *Flowmeters, Discharge(Water), Measurement, Theoretical analysis, Overflow, Laboratory tests, Discharge measurement, Discharge coefficient, Rating curves, Linear proportional weir, Head-discharge relationship.

By properly choosing the geometric parameters, a linear head discharge relationship can be achieved for simple quadrant plate weirs which have triangular and circular forms for the base weir. Studies have indicated that a simple quadrant plate weir with a rectangular base weir has linear head-discharge characteristics. The present study was related to the characteristics of the quadrant plate weir having other geometric shapes for the base weir. A linear head-discharge relationship is obtained for these weirs by properly choosing the geometric parameters of the weir. The effect of the base weir shapes on the characteristics of the weir flow was examined. Design curves were presented for the quadrant plate weirs which have the conventional shapes for the base weir, namely, the rectangular, the triangular, and the arc of a circle. (Humphreys-ISWS)
W79-07314

MAPPING OF SEA ICE AND MEASUREMENT OF ITS DRIFT USING AIRCRAFT SYNTHETIC APERTURE RADAR IMAGES,
Technische Hochschule, Graz (Austria).
F. Leberl, M. L. Bryan, C. Elachi, and T. Farr.
Journal of Geophysical Research, Vol. 84, No. C4, p 1827-1835, April 20, 1979. 8 fig, 26 ref, 2 append.

Descriptors: *Sea ice, *Mapping, *Alaska, *Remote sensing, *Tracking techniques, *Arctic, Movement, Measurement, On-site investigations, Surveys, Instrumentation, Methodology, Analysis, Analytical techniques, Algorithms, Radar, *Prudhoe(AL), Side-looking radar.

Side-looking radar images of Arctic sea ice were obtained as part of the Arctic Ice Dynamics Joint Experiment. Repetitive coverages of a test site in the Arctic were used to measure sea ice drift, employing single images and blocks of overlapping radar image strips; the images were used in conjunction with data from the aircraft inertial navigation and altimeter. Also, independently measured, accurate positions of a number of ground control points were available. Initial tests of the method were carried out with repeated coverages of a land area on the Alaska coast (Prudhoe). Absolute accuracies achieved were essentially limited by the accuracy of the inertial navigation data. Errors of drift measurements were found to be about + or - 2.5 km. Relative accuracy is higher; its limits are set by the radar image geometry and the definition of identical features in sequential images. The drift of adjacent ice features with respect to one another could be determined with errors of less than + or - 0.2 km. (Humphreys-ISWS)
W79-07327

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 2: WATER-QUALITY, METEOROLOGIC AND HYDROLOGIC DATA COLLECTED WITH AUTOMATED FIELD STATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 5G.
W79-07387

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1978--VOLUME 1. NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Geological Survey Water-Data Report NY-78-1, April 1979. 520 p, 8 fig, 1 tab.

Descriptors: *New York, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water anaysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water quality of precipitation; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 188 gaging stations; stage only at 22 gaging stations; stage and contents at 21 lakes and reservoirs; water quality at 67 gaging stations, 10 precipitation stations, and 10 wells; and water levels at 44 observation wells. Also included are data for 144 crest-stage, 20 low-flow, and 7 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in volume 2 (Long Island) represent that part of the National Water Data System operated by the U.S. Geological Survey in cooperation with State, Federal, and other agencies in New York. (Woodard-USGS)
W79-07009

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1978--VOLUME 2. LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Geological Survey Water-Data Report NY-78-2, February 1979. 264 p, 8 fig, 1 tab.

Descriptors: *New York, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Long Island(NY).

Water resources data for the 1978 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water quality of precipitation; and water levels and water quality of ground water wells. This volume contains records for water discharge at 16 gaging stations; water quality at 18 gaging stations, 403 wells, and 2 precipitation stations; and water levels at 123 observation wells. Also included are data for 81 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data together with the data in volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey in cooperation with State, Federal, and other agencies in New York. (Woodard-USGS)
W79-07010

THE TUSCALOOSA AQUIFER SYSTEM IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
E. H. Boswell.
Geological Survey Water-Resources Investigations 78-98 (open-file report), 1978. 3 sheets, 25 fig, 2 tab, 31 ref.

Descriptors: *Mississippi, *Groundwater resources, *Aquifer characteristics, *Water quality, *Water utilization, Maps, Water wells, Water levels, Well data, Water yield, Groundwater availability, Water supply, *Tuscaloosa Group, Gordo Formation, Coker Formation, Lower Cretaceous series, Cretaceous aquifers.

A three-sheet map report describes the Tuscaloosa aquifer system in Mississippi. The Tuscaloosa aquifer system, of Cretaceous age, is in the interconnected irregular sand and gravel beds in the Coker and Gordo Formations. The aquifer contains freshwater in an area of about 9,000 sq mi in northeastern Mississippi. Water produced from the aquifer by about 90 water systems and numerous industries in 1975 averaged about 47 Mgal/d. Regional water level declines have averaged less than two feet per year and the aquifer has a large potential for future development. The aquifer is used in some areas where the dissolved-solids concentration is more than 500 mg/L and where wells exceed 2,000 ft in depth. The most common problems in water supplies are excessive chloride and iron. (Woodard-USGS)
W79-07020

SURFACE WATER QUALITY AND BUILT-UP AREAS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, F. S. Banach, and E. H. Handman.
Availability: Branch of Distribution, USGS 1200 S. Eads St. Arlington VA 22202 Price $.75. Geological Survey Miscellaneous Field Studies Map MF-981-C, 1978. 1 sheet.

Descriptors: *Maps, *Water pollution sources, *Urbanization, *Waste disposal, *Connecticut, Industrial waste, Sewage, Water treatment, Urban runoff, Sampling, Water quality control, Water analysis, Aquifers.

A map of Connecticut, scale 1:125,000, shows locations of 159 State, municipal, and private sewage treatment facilities, 325 sites of industrial effluent discharge, and 47 surface-water sampling sites. Built-up areas (source of urban runoff) and favorable aquifers are also delineated. (Woodard-USGS)
W79-07021

DISPOSAL OF SOLID WASTES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, T. H. Pregman, and E. H. Handman.
Availability: Branch of Distribution, USGS 1200 S. Eads St. Arlington VA 22202 Price $.75. Geological Survey Miscellaneous Field Studies Map MF-981-B, 1978. 1 sheet.

Descriptors: *Maps, *Waste disposal, *Solid wastes, *Connecticut, *Landfills, Incineration, Water pollution sources, Water quality control, Aquifers.

A map of Connecticut, scale 1:125,000, shows more than 250 sites concerning solid waste disposal. The sites include incinerators, industrial waste, bulky or demolition waste, mixed waste and waste-transfer stations. Closed as well as active facilities and their relation to favorable aquifers are shown. Groundwater contamination is reported at 14 of the sites. (Woodard-USGS)
W79-07022

WATER AVAILABILITY, CHAMBERS COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
R. V. Chandler, and G. C. Lines.
Alabama Geological Survey Map 133, 1974. 29 p, 10 fig, 4 tab, 14 ref.

Descriptors: *Available water, *Groundwater resources, *Surface waters, *Water quality, *Water utilization, Maps, Streamflow, Well data, Water levels, Aquifers, Water analysis, Chemical analysis, Alabama, *Chambers County.

Large quantities of surface water are available for use in Chambers County, Ala. Without storage, supplies of 100 Mgal/d (million gallons per day) or more are available from the Chattahoochee and Tallapoosa Rivers; 10 Mgal/d or more are available from five of the larger creeks in the county; and 2 Mgal/d or more are available from six other creeks in the county. Even larger quantities are available from streams by providing storage. Only small to moderate quantities of ground water are available from wells penetrating metamorphic rocks in the county. Some wells produce as much as 75 gal/min (gallons per minute), but most wells produce less than 10 gal/min. Water in the county is of good chemical quality and is suitable for most uses. Surface water is soft and has a low dissolved-solids content. Water in most streams is neutral to slightly alkaline. Ground water ranges from soft to hard but generally is soft. Iron in ground water locally contains more than 0.3 milligrams per liter but, otherwise, is suitable for most uses. Total water use in the county in 1969 was estimated to be only about 3.9 Mgal/d, which is less than 1 percent of the amount of water available for use. Estimated surface-water withdrawal is about 3.3 Mgal/d, most of which is for industrial and municipal supplies. About 0.6 Mgal/d of ground water is withdrawn for domestic and irrigation supplies. (Woodard-USGS)
W79-07023

WATER AVAILABILITY IN BIBB COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
L. V. Causey, J. R. Willmon, and J. S. Ellard.
Alabama Geological Survey Map 144, 1978. 16 p, 3 fig, 2 plates, 3 tab.

Descriptors: *Available water, *Groundwater resources, *Surface waters, *Water quality, *Water utilization, Maps, Streamflow, Well data, Water levels, Aquifers, Water analysis, Chemical analysis, Alabama, *Bibb County.

The largest sources of water in Bibb County in central Alabama are limestone, dolomite, and sand aquifers, and Cahaba and Little Cahaba Rivers. Potential sources of 0.5 Mgal/d (million gallons per day) or more per well are limestone and dolomite aquifers in topographic lows in the northern part of the county; limestone and dolomite aquifers in topographic lows and along faults in the central part; and sand aquifers in the southern part. The total average flow of all streams in the county is about 1,260 Mgal/d, of which 590 Mgal/d originates within the county. The Cahaba River at Centreville has an average flow of 1,000 Mgal/d and a 7-day Q2 (median annual 7-day low flow) of about 130 Mgal/d. The Little Cahaba River near Brierfield has an average flow of 130 Mgal/d and a 7-day Q2 of about 30 Mgal/d. Wells in northern and central parts of the county are rarely drilled deeper than 300 feet. Wells in the southern part of the county generally range in depth from 150 feet in the Cahaba River valley to 800 feet in upland areas. Water from aquifers and streams in Bibb County is generally of suitable chemical quality for most uses. Water from sand and sandstone aquifers is generally soft to moderately hard and generally contains iron in excess of 0.3 mg/L (milligrams per liter). Water from limestone and dolomite aquifers is generally moderately hard to hard and has an iron content less than 0.3 mg/L. Water from streams is generally soft to moderately hard and has a dissolved-solids content of less than 150 mg/L. The average use of water in Bibb County in 1969 was about 1.4 Mgal/d which is less than 1 percent of the quantity available. (Woodard-USGS)
W79-07024

NONSEWERED BUILT-UP AREAS AND SEPTAGE DISPOSAL SITES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, and J. W. Bingham.
Availability: Branch of Distribution, USGS 1200 S. Eads St. Arlington VA 22202 Price $.75 Geological Survey Miscellaneous Field Studies Map MF-981-E, 1978. 1 sheet.

Descriptors: *Maps, *Water pollution, *Septic tanks, *Sewage lagoons, *Connecticut, Aquifers, Waste disposal, Housing developments.

A map of Connecticut, scale 1:125,000, shows nonsewered built-up areas in relation to favorable aquifers and locations of 35 septage disposal lagoons. Inset maps show distribution of housing units and individual septic systems and wells by county. (Woodard-USGS)
W79-07025

INDUSTRIAL AREAS AND GROUND DISPOSAL OF INDUSTRIAL WASTES IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, E. H. Handman, and I. G. Grossman.
Availability: Branch of Distribution, USGS 1200 S. Eads St. Arlington VA 22202 Price $.75 Geological Survey Miscellaneous Field Studies Map MF-981-D, 1978. 1 sheet.

Descriptors: *Maps, *Water pollution sources, *Waste disposal, *Sites, *Connecticut, Industrial wastes, Metals, Sludge disposal, Organic matter, Water quality control, Aquifers.

A map of Connecticut, scale 1:125,000, shows locations of disposal sites for metallic sludges, solvents, and other organic wastes and their relation to favorable aquifers. The map also delineates land areas used for light and heavy manufacturing and processing. Ground-water contamination is reported at 19 of the sites. (Woodard-USGS)
W79-07026

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
For primary bibliographic entry see Field 6B.
W79-07063

ISOTOPIC ABUNDANCES OF LEAD IN ESTUARINE SEDIMENTS, SWANSEA BAY, BRISTOL CHANNEL,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W79-07148

LEAD-210 CHRONOLOGY IN RELATION TO LEVELS OF ELEMENTS IN DATED SEDIMENT CORE PROFILES,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W79-07149

ORGANIC CARBON ISOTOPE RATIOS IN RECENT SEDIMENTS IN THE ST. LAWRENCE ESTUARY AND THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 2L.
W79-07150

MATHEMATICAL MODELING OF DRAINAGE WATERSHEDS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
K. L. Campbell, H. P. Johnson, and S. W. Melvin.
Meeting preprint 2373, American Society of Civil Engineers Annual and National Convention, Kansas City, MO, October 21-25, 1974. 17 p, 6 fig, 18 ref, 1 append. ASCE, New York. OWRT A-024-IA(4).

Descriptors: *Model studies, *Computer models, *Mathematical models, *Drainage practices, *Watershed management, Surface runoff, Hydrology, Hydrologic systems, Flood forecasting, Flood control, Flow rates, Water quality, Nutrients, Sediments, Iowa State Hydrologic Model.

Recent research evaluating mathematical models in determining the hydrologic response of watersheds to drainage practices is examined. A discussion of the results and views of various drainage practices reveals that complex interactions take place in hydrologic systems when the environment is modified by artificial drainage. Two watershed models and the types of parameters are considered: the deterministic or simulation approach which is composed of many component models, each of which represents one of the hydrologic processes; and the conceptual type model in which some parameters are determined by fitting. A mathematical model, the Iowa State University Hydrologic Model, developed from a deterministic simulation approach is described and illustrated by a schematic diagram. The increasing accuracy of the numerous approximations of this model must be evaluated with regard to the resulting increased computer costs. Mathematical models depicting the rates and quantities of flow under various hydrologic conditions and degrees of drainage also offer the opportunity to model the quality of water flowing from drainage watersheds. Because of the many interacting factors affecting watershed response, it is concluded that mathematical models are the only available tool to explore the magnitude and type of hydrologic response, qualitatively and quantitatively, which result from combinations of drainage practices. (Davison-IPA)
W79-07169

LOCAL ENVIRONMENTAL MANAGEMENT-CAN IT WORK. A CASE STUDY OF THE VIRGINIA WETLANDS ACT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 7B.
W79-07281

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 2: WATER-QUALITY, METEOROLOGIC AND HYDROLOGIC DATA COLLECTED WITH AUTOMATED FIELD STATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 5G.
W79-07387

8. ENGINEERING WORKS

8A. Structures

FIELD INVESTIGATION OF SHIPBOARD/SHORESIDE SEWAGE TRANSFER SYSTEMS AT THE SAN DIEGO NAVAL STATION,
Pollution Abatement Associates, Corte Madera, CA.
R. W. Urban, D. J. Graham, and F. J. Campbell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 974, Price codes: A12 in paper copy, A01 in microfiche. Report 1978. 150 p, 55 fig, 13 tab, 2 append.

Descriptors: *Ships, *Sewerage, *On-site tests, *Sewage disposal, *Water pollution sources, Regulation, Design, Waste water.

Field tests were conducted of Navy ship-to-shore sewage transfer including tests of installed shipboard Collection, Holding, and Transfer systems (CHT). Procedures for connecting and disconnecting nests of ships were developed and documented. Also, the effect of pier sewer system loading by multiple ship sewage discharge was examined. Sewage generation rates from activated CHT systems were monitored. Shipboard CHT systems and pierside sewers were a simple and effective way to transport shipboard waste to treatment facilities on the shore. Work with 21 different ships yielded various recommendations, including shipboard CHT operating procedures, shipboard CHT hard-

ware, shoreside hardware and procedures, and shipboard CHT activation. The major problem encountered during the field tests was the general reluctance of all ships to begin operation of CHT systems, although many were certified or near certification. Most systems had sufficient problems to justify postponing use until required by law. In some cases, an additional week of work was necessary to activate the CHT system. Activation of key vessels in key ports will make the use of CHT more widespread and more visible throughout the fleet. (Small-FRC)
W79-07040

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07061

COST-EFFECTIVENESS STUDIES OF SANITARY SEWERAGE SYSTEMS METHODOLOGY AND DEMONSTRATION,
Veenstra and Kimm, West Des Moines, IA.
For primary bibliographic entry see Field 6B.
W79-07063

TROUT FARM REQUIRES CONSTANT FLOW, GOOD QUALITY WATER,
For primary bibliographic entry see Field 8I.
W79-07200

PRESIDENT CARTER ANNOUNCES WATER POLICY INITIATIVES,
For primary bibliographic entry see Field 6E.
W79-07276

INSUFFICIENT EIS HALTS HYDRO-ELECTRIC PROJECT,
For primary bibliographic entry see Field 6E.
W79-07279

DRAKENSBERG SCHEME IN FULL SWING,
J. B. Bowcock.
South African Tunnelling: Vol. 2, No. 4, Supplement to Construction in S. A. and Coal, Gold, and Base Minerals of S. A., p 6-9, 11-13, July 1978. 5 fig, 3 ref.

Descriptors: *Tunneling, *Tunnels, *Water storage, *Pumped storage, *Pumping plants, *Storage, *Electricity, Excavation, Rock mechanics, Geology, Geologic investigations, Underground, Construction, Drilling equipment, Contract, Testing, Structures.

The Drakensberg Pumped Storage Scheme, currently under construction near Bergville, Natal, will be used to store surplus off-peak energy for the Electricity Supply Commission (Escom); it will also pump water over the Drakensberg escarpment into the Vaal catchment for the Department of Water Affairs. The project is sited within rock of the Beaufort series of the Karoo System beneath the south facing slope of the escarpment. In addition to sandstones, siltstones, and mudstones, there are occasional thin carbonaceous seams of poorly developed fossil leaf remains. The presence of these seams means that all underground work must be done under mine fire regulations because of the possibility of flammable gases. The exploratory phase geological investigation program included: (1) geological investigations comprising excavation of shafts and adits, core drilling from the surface and underground, permeability tests in boreholes, and geophysical investigations; (2) geotechnical testing comprising plate bearing tests, in situ stress measurements, and borehole modulus tests. A double corrosion protected system is used in the main halls to protect the rock bolts of the main support, because of high chloride content in the water. The construction contracts are discussed. (Davison-IPA)
W79-07353

KOEBERG HARBOUR FEATURES AN IMPERVIOUS BREAKWATER,
W. Robinson.
Construction in Southern Africa, Vol. 23, No. 4, p 20-25 and 29, July 1978. 7 fig.

Descriptors: *Powerplants, *Nuclear powerplants, *Breakwaters, *Water cooling, Engineering structures, Intakes, Dredging, Construction materials, Precast concrete, Rockfill dams, Koeburg Harbor(South Africa).

South Africa's first nuclear power station is being constructed on the Atlantic coast 35 km north of Capetown. All water required for cooling the power station turbine condensers will be taken from the sea. Rough sea swells in the area of the power station necessitated the incorporation of an impervious breakwater. The intake basin to be built around the cooling water inlet will prevent rough water from entering the water inlet structure and will inhibit the warm water from the cooling water outlet from directly re-entering the inlet structure. This basin will be formed by two breakwaters constructed in rockfill with precast concrete dolosse armoring and mass concrete capping. Breakwater construction details are given. The layout of the site is described. (Davison-IPA)
W79-07354

GRAND COULEE THIRD POWERPLANT, DEGRADATION STUDY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2E.
W79-07369

CLARENCE CANNON DAM AND RESERVOIR: COST, SCHEDULE, AND SAFETY PROBLEMS. CORPS OF ENGINEERS (CIVIL FUNCTIONS) DEPARTMENT OF THE ARMY,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-07383

FLOATING BREAKWATER,
R. B. Fuller.
U.S. Patent No. 4,136,994, 9 p, 9 fig, 6 ref; Gazette of the United States Patent Office, Vol. 978, No. 5, p 1718, January 30, 1979.

Descriptors: *Patents, *Breakwaters, *Coastal structures, Floating, Waves(Water), Energy, Shore protection, Energy conversion, Turbines.

A floatable breakwater comprises an open grid with a troughlike membrane suspended below the grid. Inner membrane components which are also suspended from the floatable grid serve to define various ports or apertures through which the water is moved and churned as the breakwater is lifted by a passing wave and thereby dissipate energy from the wave. These inner membrane components may have a truncated tetrahedral configuration converging downward in the manner of multiple funnels so that the water contained within the respective tetrahedron is ejected downwardly into the outer troughlike membrane when each passing wave momentarily elevates the breakwater. A turbine may be positioned at one end of the breakwater for converting the energy of the longitudinal flow of water out of the troughlike membrane into electric power. (Sinha-OEIS)
W79-07410

8B. Hydraulics

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07061

THE CONVERGENCE OF IMPLICIT BED TRANSIENT MODELS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, H. Indlekofer, and D. B. Simons.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14493, p 351-363, April 1979. 7 fig, 8 ref, 2 append.

Descriptors: *Alluvial channels, *Model studies, *Attenuation, *Beds, Celerity, Hydraulics, Numerical analysis, Rivers, Unsteady flow, Sedimentation, Sediments, *Channel beds, Convergence.

A comprehensive theoretical treatment of the convergence of the four-point implicit numerical model of alluvial channel bed transients was presented. The dimensionless celerity and logarithmic decrement of the analytical and numerical solutions were calculated. Convergence was tested by establishing the ratio of celerities (translation convergence) and the ratio of attenuation factors (attenuation convergence). Two physical and three numerical parameters were identified: the equilibrium flow Froude number, the transient flow dimensionless wave number, the spatial resolution, the Courant number, and the weighting factor of the scheme. (Lee-ISWS)
W79-07107

FLOW RESISTANCE IN GRAVEL-BED RIVERS,
University of East Anglia, Norwich (England). School of Environmental Science.
For primary bibliographic entry see Field 2E.
W79-07108

A REVIEW OF SOUTH AFRICA'S PROSPECTS FOR POWER FROM THE OCEAN,
Cape Town Univ. (South Africa).
G. Nuric.
South African Mechanical Engineer, Vol. 28, No. 7, p 274-282, July 1978. 9 fig, 5 tab, 18 ref.

Descriptors: *Ocean waves, *Energy conversion, *Tidal energy, *Tidal powerplants, Electric power, Electric powerplants, Electric power production, Currents(Water), Ocean circulation, Ocean currents, Tidal waters, Economics, Capital costs, Research and development, South Africa.

The various systems by which energy may be harnessed from the ocean are discussed; wave power is emphasized. Wave data taken during all seasons from several locations along the South African coastline were analyzed to determine the average power density available. At distances up to 30 km off-shore as much as 50 kW/m of wavefront are available; 10 kW/m of wavefront is available up to 1 km off-shore. Several wave power generating systems being developed on a worldwide basis are described. These ocean energy extractors are non-polluting in that they do not introduce new chemicals or heat into the atmosphere. They may introduce a temporary diversion of heat and there possibly may be small spillages of oil from hydraulic or lubrication circuits. The use of these devices as a breakwater could produce an alteration of the sea bed and modify coastal erosion and deposition patterns. Initial costs of wave power systems are high. According to a 1974 estimate, a 50 kW plant could cost R600/kW; with a 10% annual inflation rate the cost could rise to R800/kW in 1977. (Davison-IPA)
W79-07177

FLUID FLOW AND HEAT TRANSFER THROUGH HYDRAULICALLY INDUCED FRACTURS IN HOT, DRY ROCK MASSES,
Northwestern Univ., Evanston, IL. Technological Inst.
S. Nemat-Nasser, and H. Ohtsubo.
Journal of Pressure Vessel Technology, Vol. 100, p 276-284, August, 1978. 9 fig, 9 ref.

Descriptors: *Geothermal studies, *Flow, *Heat transfer, *Fractures(Geologic), Hydraulic fracturing, Rocks, Fracture permeability, Energy equation, Fluid mechanics, Momentum equation, Finite element analysis, Thermal conductivity.

Geothermal energy can be obtained from hot, dry rocks through hydraulic fracturing followed by circulation of water under pressure through the fractures and back to the ground surface. The fractures initially are very small but expansion of these fractures and formation of secondary fractures perpendicular to them results from thermal contraction. Basic two-dimensional field equations for fluid flow and heat transfer were obtained by integrating three dimensional mass, linear momentum and energy equations over the crack width. The importance of the various terms in these equations is briefly discussed, and on this basis the corresponding equations are simplified. For the steady-state case, a finite element numerical solution is presented along with illustrative examples. These examples reveal that a more accurate estimate for the effective conductivity between fluid and solid must be obtained in order to more realistically estimate the basic heat extraction process. In particular, the effect of secondary cracks must be carefully examined through further research. (Purdin-NWWA)
W79-07192

HYDRAULIC CHARACTERISTICS OF THE WHITE RIVER STREAM BED AND GLACIAL OUTWASH DEPOSITS AT A SITE NEAR INDIANAPOLIS, INDIANA,
Indiana Dept. of Natural Resources, Indianapolis.
W. Meyer.
Journal of Research of the U.S. Geological Survey, Vol. 6, No. 2, p 273-283, March-April, 1978, 11 fig, 1 tab, 8 ref.

Descriptors: *Aquifer testing, *Glacial aquifers, *Indiana, Aquifer characteristics, Stream-aquifer relationships, Hydraulic conductivity, Specific yield, Transmissivity, Streambeds, Hydrograph analysis, Well spacing, Leakage.

An aquifer test was made in the glacial-outwash aquifer underlying the White River and Fall Creek in Marion County, Indiana, to define the hydraulic connection between these streams and the aquifer and determine the hydraulic characteristics of the aquifer. This knowledge is essential for proper design and spacing of wells. The data were analyzed for an assumed condition of negligible transient leakage from the clay lens underlying this unit. Because no observation wells were installed in the clay lens, this assumption cannot be directly substantiated. However, observation wells beneath the clay lens indicated that a head loss was not induced below the clay lens by the test well. The analysis of the test data was complicated by a minor flood pulse on the White River. Background data on the response of ground water levels to changes in stream stage were used in the analysis of the aquifer-test data. Lateral hydraulic conductivity of the upper sand and gravel unit at the test site was determined to be 108 m/d. Transmissivity ranged from 1500 to 1670 m2/d. the specific yield was determined to be 0.08. The vertical hydraulic conductivity of the streambed was calculated to be 2.2 m/d. (Purdin-NWWA)
W79-07198

MULTIPLE OPERATING POINTS IN COMPLEX PUMP NETWORKS,
Southern Methodist Univ., Dallas, TX. School of Engineering and Applied Science.
M. A. Collins, L. Cooper, and J. L. Kennington.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, p 229-244, March 1979. 8 fig, 1 tab, 27 ref, 2 append. OWRT C-3355(3739)(6).

Descriptors: *Pumping, *Pipe flow, Networks, Model studies, Mathematical models, Pumps, Pipes, Pipelines, Pressure head.

Pump networks are pipe networks in which most head changes are produced by pumps. When nonmonotonicity exists in one or more pump characteristic curves, possibility of multiple operating points exists. An optimization model for steady state networks of arbitrary topology, complexity, and size was presented. Stationary points of the optimization model defined possible operating points. Uniqueness conditions as well as conditions for possible multiple operating points were identified. Operating points can correspond to minimums, maximums, or saddle points of the optimization model objective function. A two pump network example illustrated the different possibilities. It was concluded that the stationary point character defines the relative stability of different steady state operating points. (Sims-ISWS)
W79-07228

SOLVE LINEAR PROPORTIONAL WEIR DESIGN QUICKLY,
Indian Inst. of Tech., Bombay.
For primary bibliographic entry see Field 7B.
W79-07314

THE RANCE POWER STATION,
For primary bibliographic entry see Field 8C.
W79-07344

INFLUENCE OF PUMPED STORAGE FLOWS ON THERMAL STRATIFICATION IN RESERVOIRS,
West Virginia Univ., Morgantown, WV. Dept. of Mechanical Engineering and Mechanics.
V. Singh, R. A. Bajura, and S. H. Schwartz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 131, Price codes: A08 in paper copy, A01 in microfiche. Final Report, January 1979, 155 p, 73 fig, 6 tab, 55 ref, 3 append. OWRT C-7171(214)(5). 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, Stratification, Reynolds number, Buoyancy, Numerical analysis, Hydraulic structures.

The characteristics of buoyant submerged horizontal jets which simulate the discharge from power plants were found to be dependent upon the Froude number and the jet and ambient water temperatures. The concentration of salt solutions used to simulate the buoyancy mechanism in some of the tests was observed to alter the mixing characteristics of the jets. A series of tests was conducted to determine the mixing which would occur in two tanks simulating a pumped storage reservoir system after a number of cycles of operation. The mixing in the reservoirs was also simulated using a numerical computational scheme in two dimensions. The numerical predictions were in qualitative agreement with the experimental results. In several tests the vertical scale was exaggerated compared to the horizontal scale of the model in order to facilitate measurements and flow observations. When a simulated 200 MW power plant was operated with models which were distorted vertically by a factor of 3 and 5, respectively, the mixing in the distorted system was significantly greater than the mixing observed in the nondistorted model. It is expected that the use of distorted models will introduce large errors in the prediction of the performance of a prototype system.
W79-07365

8C. Hydraulic Machinery

THE RANCE POWER STATION,
Imiesa, Vol. 3, No. 9, p 12-15. 1978, 11 fig.

Descriptors: *Tidal powerplants, *Hydroelectric power, *Rance Power Station(France), Tidal energy, Tidal effects, Water level fluctuations, Turbines, Generators, Power system operation, Facilities, Electric power demand, Electric power production, Tides.

The tidal power station at the mouth of the River Rance, the first plant in the world to harness tidal energy, has a total output of 240 MW when all 24 generators are in operation. The plan, begun in 1961 and completed six years later, is based on the 'bulb' type generator which permits combining of pumping and generating cycles. The generator can operate as a direct turbine (basin-to-sea), and as a direct pump (sea to basin) or reverse. By selecting the methods of combined operation it becomes possible to overcome the limitations imposed by the lunar rhythm to concentrate on power production during hours of maximum demand. Pumping, always done at times of loss of head, uses off-peak electricity. The operation of the powerplant and the layout of the station are described. (Davison-IPA)
W79-07344

A BOREHOLE PROBE FOR SAMPLING GROUNDWATER FROM SELECTED STRATA,
Council for Scientific and Industrial Research, Pretoria, (South Africa). Technical Services Dept.
E. M. Thain, and P. H. H. Trendler.
Water S. A., Vol. 4, No. 2, p 49-53, April 1978. 6 fig.

Descriptors: *Hydraulic machinery, *Pumps, *Groundwater, *Boreholes, Equipment, Sampling, Testing, Electric wiring, Research equipment, Research and development, Instrumentation.

A borehole sampling device capable of collecting groundwater samples up to a maximum depth of 200 m is described. Portions of the borehole are sealed off by the device, allowing the water between the seals to be pumped to the surface for age determination, or to be collected in canisters for trace metal and chemical analysis. This device contains a submersible pump, and consists of a probe, sample holder canisters, a water sensing mechanism, a specially designed lowering device with electrical winch, clamps, and a drum for the electric cables and plastic tubes. The device operated successfully during testing of the probe and lowering mechanism. Preliminary tests indicate that the probe will be able to pump water to the surface from specific strata for age determination sampling. A schematic diagram of the probe is provided. (Davison-IPA)
W79-07361

PREVENTATIVE MAINTENANCE: YOUR MOST IMPORTANT INVESTMENT.
Water Well Journal, Vol. 33, No. 6, p 51-54, June, 1979.

Descriptors: *Drilling equipment, *Maintenance, *Safety, Lubricants, Investments.

Factors to consider in selecting a suitable drilling rig are capacity, average hole size, operating location, amoung of use, and the type of maintenance required. Preventive maintenance of a drilling rig is essential for warranty protection and getting the most out of the rig. If properly selected and used, a regularly serviced drilling rig can operate for more than 8000 hours without requiring an overhaul or major repairs. Basic maintenance procedures for drilling rigs are outlined. Service steps for various parts are given in daily, weekly, biweekly, monthly, bimonthly, quarterly, and semi-annual intervals. Proper lubrication is the key to good maintenance for any part. Thinner oils are required for very cold climates while, in hot weather, heavier oils are recommended. For altitudes greater than 8000 feet a turbocharger should be added to the engine. Recommended safety precautions are listed which will prevent damage to the machine and insure the safety of the crew. (Purdin-NWWA)
W79-07498

8D. Soil Mechanics

SLIMES DAMS: PROFESSIONAL EXPERTISE FOR SUCCESS,
J. Caldwell.
S. A. Mining and Engineering Journal, Vol. 89, No. 4143, p 43 and 47, August 1978.

Descriptors: *Dams, *Dam construction, *Dam design, *Mining engineering, *Waste disposal, Settling basins, Mine wastes, Design criteria, Inspection, Construction, Water requirements, Erosion control, Rainfall, Runoff, Barriers, Evaporation control.

Group 8D—Soil Mechanics

The essential aspects for the successful design and construction of slimes dams are examined. To determine the size of the dam and its length of useful life, it is necessary to ascertain the quantity of proven ore reserves and estimate the probably ore reserves; milling process information should be defined and the physical nature of slimes must be known. The type of operation must be selected. Theoretical design considerations include stability under static and dynamic loading, retention of all precipitation (rain), retention of runoff through barrier and evaporation dams, and storage capacity of at least 0.5 m above the maximum expected water level. Barrier dams should be provided at the toe of all dams and dumps to contain runoff resulting from precipitation on slimes dams and dumps, to control and contain eroded material erosion from the side of the slimes dam, and to act as evaporation dams. Settling ponds may be preferable to barrier dams in areas of steep topography. A check list for periodic dam inspection is discussed. It is concluded that the success of the design depends on bringing these divergent elements together. (Davison-IPA)
W79-07181

DRAKENSBERG SCHEME IN FULL SWING,
For primary bibliographic entry see Field 8A.
W79-07353

KOEBERG HARBOUR FEATURES AN IMPERVIOUS BREAKWATER,
For primary bibliographic entry see Field 8A.
W79-07354

8E. Rock Mechanics and Geology

FLUID FLOW AND HEAT TRANSFER THROUGH HYDRAULICALLY INDUCED FRACTURS IN HOT, DRY ROCK MASSES,
Northwestern Univ., Evanston, IL. Technological Inst.
For primary bibliographic entry see Field 8B.
W79-07192

AN APPRAISAL OF UNDERGROUND RADIOACTIVE WASTE DISPOSAL IN ARGILLACEOUS AND CRYSTALLINE ROCKS: SOME GEOCHEMICAL, GEOMECHANICAL AND HYDROGEOLOGICAL QUESTIONS,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 5E.
W79-07196

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 5. GENERAL GEOLOGY AND SEISMICITY,
Army Engineer Waterways Experiment Station, Vicksburg, MI. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 2F.
W79-07386

8G. Materials

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07061

GLASS FIBRE PROTECTION FOR OUR LIFE LINES,
South African Bureau of Standards, Bulletin 7, No. 7, p 431-433, April 1978. 2 fig.

Descriptors: *Coatings, *Protective coatings, *Corrosion control, *Reinforcements, *Standards, Specifications, Glass fiber, South African Bureau of Standards, Coal tar coatings, Bituminous materials, Linings, Tensile strength, Binders, Porosity.

The South African Bureau of Standards has produced SABS 1130, a specification covering the quality of three types of glass fiber reinforcing material. Type 1 is a glass fiber mat with low tensile strength intended for use as an inner wrap. Type 2 is a woven glass fiber scrim coated with bitumen; it has high tensile strength in the longitudinal and transverse directions with low binder holding capacity, and is intended for use in the outer layers of the coating. Type 3 is a woven or bonded glass fiber scrim combined with random glass fiber mat for tensile strength in both directions equal to or better than Type 2, with porosity and binding capacity similar to Type 1. It may be used for both inner and outer layers of the coating. This glass fiber reinforcing material has been used internally and externally as a corrosion preventative in steel pipes for transporting water from storage dams to the areas of need. Pipes coated with bitumen only proved unsatisfactory, because bitumen was subject to physical damage in transit and by rock penetration. Heasian was once used as a reinforcing material, but this organic material eventually rotted and failed. Glass fiber reinforcing material has proved most successful. (Davison-IPA)
W79-07359

8I. Fisheries Engineering

INTAKE TECHNOLOGY MOVES AHEAD,
McGraw-Hill Inc., New York.
W. O'Keefe.
Power, p 50-54, January 1978, 12 fig. McGraw-Hill, New York.

Descriptors: *Engineering structures, Fish passages, Intakes, Entrainment.

Ideas and equipment for fish protection at generating station intakes are reviewed. Suggestions for consideration in design are fish size, water velocity, plant and intake siting, air bubble barriers, light, sound, jetted water, pulsed electricity, chain screens, louvers, trashracks, pumps and filtration devices. (Chilton-ORNL)
W79-07008

ENGINEERING CONSIDERATIONS IN THE USE OF ARTIFICIAL FILTER BEDS,
Burns and Roe, Inc., Paramus. Dept. of Hydraulic Engineering.
R. T. Richards.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 5-12, 5 fig, 4 ref. 1978.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Cooling water, Fish, Powerplants, Filters, Artificial filter beds.

Preliminary engineering for an artificial filter system is discussed in connection with a proposed 1.6 cubic m/s-capacity filter in the Columbia River. Major engineering problems for filter beds are identified as development of a suitable and stable filter medium; design of a reliable backwash system which is both effective and environmentally acceptable; meeting of all site-imposed restrictions; and provision of civil and mechanical engineering design inherent in such a syste. It was concluded that the majority of future filter engineering will be site-related and will require a new design for each project. (See also W79-07080) (Chilton-ORNL)
W79-07081

HIGH-CAPACITY FILTERS FOR POWER PLANT COOLING WATER INTAKES,
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 13-14, 1978. 4 ref.

Descriptors: *Environmental effects, *Engineering structures, Entrainment, Fish, Larvae, Filters, Models, *Impingement.

A high-capacity model filter for preventing entrainment and impingement of pelagic eggs and larval fishes as power plant intakes was tested at a proposed plant site in Puget Sound. Model filter studies, fouling control techniques and an engineering design concept were reviewed. It was concluded that, while filter intake systems could be an attractive and effective technology for the exclusion of pelagic eggs and larval fishes, the present technology is not sufficiently developed to allow reliable design and operation. (See also W79-07080) (Chilton-ORNL)
W79-07082

COOLING WATER INTAKES UTILIZING RANNEY COLLECTORS OR RANNEY INTAKES,
Ranney Method Western Corp., Kennewick, WA.
F. C. Mikels, and T. W. Bennett.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 15-25, 1978. 3 fig, 4 tab, 14 ref.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Intakes, Powerplants, Design, Aquatic life, *Impingement.

The two types of intakes discussed in this paper are the Ranney Collector, a subsurface intake using natural sand and gravel deposits to transmit water from a surface source, and the Ranney Surface Water Intake, a submerged horizontal perforated-pipe intake. Ranney Collectors are reported to offer the best available technology for minimal environmental impact. The chief limitation of the collectors is that of hydrogeology. Ranney Collectors can be successfully installed only in areas where there are permeable sand and gravel aquifers connected hydraulically with a surface source. Ranney Surface Water Intakes are applicable to either small or large demand requirements. Intake screen openings may be of any size or shape considered to be environmentally suitable. The screens are located sufficiently far above the bottom of the stream or lake so as to have little effect on bottom-dwelling organisms. Greatest potential danger to effective and efficient long-term operation of this intake is the improper placement of screens within the streambed. (See also W79-07080) (Chilton-ORNL)
W79-07083

HYDROLOGIC ENGINEERING CONSIDERATIONS FOR RANNEY COLLECTOR WELL INTAKE SYSTEMS,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
N. J. Beskid.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 27-36, 1978. 6 fig, 7 ref.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Intakes, Powerplants, Design, Fish, Aquatic life, *Impingement.

The hydrologic parameters which govern the operation of a Ranney Collector Well and the factors that limit its installation and use are discussed. Ranney Collector Well intakes incur virtually no fish impingement or entrainment; pose no threat to navigation; and remove less water from streams during low flow than do conventional stream intakes. Groundwater is supplied by the process of induced infiltration. Problems requiring site-specif-

ic design are outlined. (See also W79-07080) (Chilton-ORNL)
W79-07084

AN ENGINEERING EVALUATION OF POROUS-DIKE INTAKE SCREENING SYSTEMS,
Worcester Polytechnic Inst. Holden, MA. Alden Research Lab.
J. C. Roberge.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 37-50, 1978. 14 fig, 2 tab, 11 ref.

Descriptors: *Environmental effects, *Engineering structures, Powerplants, Cooling water, Intakes, Filters, Entrainment, Design.

Experimental data on energy losses for various dike materials and flow conditions are presented and compared with those in available literature. Analysis is made of factors governing energy losses to indicate which parameters need further clarification and standardization. A hypothetical porous-dike installation was described and it was concluded that empirical design techniques are available and are currently being refined; the porous dike screening concept is economically competitive with other exclusion systems; and a comparison of the various screening concepts operating under carefully monitored field conditions is needed to gain a more complete understanding of their relative engineering feasibility, biological performance, and cost effectiveness. (See also W79-07080) (Chilton-ORNL)
W79-07085

BIOLOGICAL ASPECTS OF POROUS-DIKE INTAKE STRUCTURES,
New England Power Serice Co., Westborough, MA.
For primary bibliographic entry see Field 5C.
W79-07086

ENGINEERING ASPECTS OF PASSAVANT SCREENING,
Passavant Corp., Birmingham, AL. Solids Disposal Div.
K. R. Siddle, and R. K. Sharma.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 65-68, 1978. 1 fig, 1 tab.

Descriptors: *Environmental effects, *Engineering structures, *Entrainment, Powerplants, Cooling water, Aquatic life, Intakes, Filters, Screens, Passavant screens.

Design and operation of the Passavant screen, a traveling screen in which water enters between the front and back belts and travels laterally through either, is described. Mesh size of the screening material can be selected. Screened organisms are retained in the retaining lip and are not exposed to air as the basket rotates and is washed. Screened organisms are washed into a trough and can be returned to the source water body. Screens can be rotated at high speed (28 fpm). Baskets are easily removed for replacement of screening material. (See also W79-07080) (Chilton-ORNL)
W79-07087

INVESTIGATION ON THE PROTECTION OF FISH LARVAE AT WATER INTAKES USING FINE-MESH SCREENING IMPINGEMENT-RELEASE CONCEPT: LABORATORY STUDY OF A SINGLE-ENTRANCE, DOUBLE-EXIT, VERTICAL TRAVELING SCREEN CONCEPT,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 5C.
W79-07088

CURRENT TVA WORK ON THE FLUID MECHANICS OF SCREENS WITH VERY SMALL OPENINGS FOR THE EXCLUSION OF LARVAE AT POWER PLANT COOLING-WATER INTAKES,
Tennessee Valley Authority, Norris. Div. of Water Management.
For primary bibliographic entry see Field 5C.
W79-07090

BIOLOGICAL AND ENGINEERING CONSIDERATIONS IN THE FINE-SCREENING OF SMALL ORGANISMS FROM COOLING WATER INTAKES,
Stone and Webster Engineering Corp., Boston, MA.
Y. G. Mussalli, E. P. Taft, and P. Hoffmann.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 107-123, 1978. 12 fig, 18 ref.

Descriptors: *Engineering structures, *Environmental effects, Intakes, Cooling water, Powerplants, Aquatic life, Filters, Screens, *Impingement, *Deterrents.

Biological and engineering criteria which should be considered in selecting design parameters for an intake utilizing fine screening are discussed. These criteria include site specific selection of screen type, screenwell layout, screen mesh size, mesh material, wash systems and special features for protection of organisms. Impingement and deterrent concepts are discussed. Deterrent concepts are relatively new and the need to expand research efforts in this area is pointed out. It was concluded that impingement concepts offer the most practicable solution to larval entrainment problems at once-through cooling sites while deterrent concepts are limited to closed-loop cooling systems. (See also W79-07080) (Chilton-ORNL)
W79-07091

INVESTIGATIONS ON THE PROTECTION OF FISH LARVAE AT WATER INTAKES USING FINE-MESH SCREENING,
Tennessee Valley Authority, Norris. Div. of Forestry, Fisheries, and Wildlife Development.
For primary bibliographic entry see Field 5C.
W79-07092

ENGINEERING AND HYDRAULICS OF THE MODIFIED PERFORATED-PIPE INTAKE,
Burns and Roe, Inc., Paramus, NJ. Dept. of Hydraulic Engineering.
R. T. Richards.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 141-147, 1978. 4 fig, 7 ref.

Descriptors: *Engineering structures, *Environmental effects, Intakes, Powerplants, Screens, Aquatic life, *Perforated pipe intakes.

The perforated pipe as a screening device has been used for many years in cases involving small flow volumes. The modified perforated pipe has been changed to give uniform inflow velocities and is a relatively new concept. The modified perforated-pipe intake has been model-tested and has been in place in the Columbia River for a makeup water intake serving a nuclear power plant for several months. It was concluded that the perforated-pipe intake with improvements in design is an alternative for reliable water intake and protection of aquatic life where conditions for its installation are favorable. (See also W79-07080) (Chilton-ORNL)
W79-07093

THE JOHNSON SCREEN FOR COOLING WATER INTAKES,
Universal Oil Products, Inc., St. Paul, MN.
L. E. Cook.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 149-157, 1978. 12 fig, 1 tab, 3 ref.

Descriptors: *Engineering structures, *Environmental effects, Entrainment, Powerplants, Intakes, Cooling water, Aquatic life, Johnson screen.

Flow field modeling of Johnson surface-water screens is discussed and a series of case studies is presented. It was concluded that nearly uniform through screen velocities can be obtained by proper consideration of design variables. Advantages of uniform, low through-screen velocities are identified as: more efficient use of screen and lower head loss is an immediate result; probability of entrapment of aquatic organisms is reduced; need for cleaning is minimized; and the ratio of ambient current velocity to withdrawn velocity is maximized. (See also W79-07080) (Chilton-ORNL)
W79-07094

IN-SITU TESTING OF PROFILE WIRE SCREENS FOR LONG-TERM ENGINEERING FEASIBILITY,
Delmarva Power and Light Co., Wilmington, DE.
J. C. Miller, K. E. Charles, and T. H. Key.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 159-167, 1978. 7 fig.

Descriptors: *Engineering structures, *Environmental effects, *Fouling, Intakes, Cooling water, Powerplants, Aquatic life, Screens, Filters.

The primary objective of the in-canal test program presented was to demonstrate reliable, long-term operation of a small-slot, profile-wire screen with an operating and maintenance effort which would be acceptable in a power station installation. Test results showed that detrital clogging was significant only when the screen was heavily biofouled. Most maintenance required was due to biofouling which was heaviest from late May through early October. Average time between cleaning with high-pressure water and increase in pressure drop was 8 days. Mean times between first increase in pressure drop and first clog was 4 days; mean time between first clog and removal for cleaning was 7 days. Average time between cleanings was 19 days. No effect on rate of biofouling was observed during periods of daily backwashing tests. An air/water backwash technique appeared to be effective but required more time and effort than water backwashing. (See also W79-07080) (Chilton-ORNL)
W79-07095

LARVAL EXCLUSION SYSTEMS FOR POWER PLANT COOLING WATER INTAKES: A SYNTHESIS OF VIEWS PRESENTED AT THE WORKSHOP,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
R. K. Sharma.
In: Larval Exclusion Systems for Power Plant Cooling Water Intakes, Proceedings of a Workshop, San Diego, California, February 7-8, 1978. NUREG/CP-002; ANL/ES-66. p 235-237, 1978.

Descriptors: *Engineering structures, *Environmental effects, Powerplants, Intakes, Cooling water, Aquatic life, Entrainment, Impingement.

A summary of the papers concerning various exclusion systems which were presented at the workshop is given. These include subsurface collectors, perforated pipes, profile wire, porous dikes, artificial filter beds and fine-mesh traveling screens. Recommendations of the workshop are presented. It was concluded that no sound arguments on an ecological basis can be forwarded to screen fish larval form at all power plants. A detailed comparative cost evaluation of various concepts is needed. The subsurface collector is recommended as the most effective concept for larval exclusion if geologic and hydrologic factors permit. Biological

effectiveness of several concepts is recommended. (See also W79-07080) (Chilton-ORNL)
W79-07098

TROUT FARM REQUIRES CONSTANT FLOW, GOOD QUALITY WATER,
A. Hewitson.
Canadian Water Well, Vol. 5, No. 2, p 24-25, May, 1979.

Descriptors: *Fish farming, *Water supply, *Water wells, Water quality, Agriculture, Fish hatcheries, Canada, Drilling, Solid wastes, Sludge disposal, Fertilizers, Fish, Rainbow trout, Dissolved oxygen.

The operation of a compact, commercial trout farm which raises 150,000 rainbow trout annually is described. The water supply for the farm consists of two spring-fed streams augmented by four wells with a total flow of 1600 gpm of good quality. The wells were drilled with a rotary rig to depths ranging from 24 to 42 meters. Mixing the warmer well water with the surface water extends the growing season. The level of oxygen in the water, critical to the growth and survival rate of the trout, depends primarily on water quality. The good quality of the water supply is maintained with degassers which force oxygen through the water and drive off hydrogen into the atmosphere and with a system of continuous solid waste removal. Much of the sludge from the waste disposal tank is used as an agricultural fertilizer. (Purdin-NWWA)
W79-07200

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

MUNICIPAL WATER POLLUTION CONTROL ABSTRACTS: NOVEMBER 1976-OCTOBER 1977,
Franklin Research Center, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07061

ADDRESS OF THE RETIRING PRESIDENT OF THE INTERNATIONAL ASSOCIATION OF SEDIMENTOLOGISTS: DIFFERENCES IN SIZE DISTRIBUTIONS OF POPULATIONS OF PARTICLES AMONG SANDS OF VARIOUS ORIGINS,
Rensselaer Polytechnic Inst. Troy, NY. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W79-07152

SUBJECT INDEX

208 PLANNING
Proceedings, North Carolina 208 Problem Assessment Workshop, May 4, 1977, Raleigh,
W79-07391 6B

ABATEMENT
Research Initiation--Optimal Control of Artificial Aeration in Polluted Rivers,
W79-07070 5G

ABSORPTION
Determination of Inorganic and Total Mercury, in Water and Effluents by Flameless Atomic Absorption, (Bepaling van Angorganiese en Totale Kwik in Water en Ultvloeisels deur Vlamlose Atoomabsorpsie,)
W79-07360 5D

ABSTRACTS
Municipal Water Pollution Control Abstracts: November 1976-October 1977,
W79-07061 5D

ACID MINE WATER
The Effect of Acid Mine Drainage Water on Two Pennsylvania Soils,
W79-07251 5C

Charged Membrane, Low Pressure Ultrafiltration to Treat Acid Mine Drainage Waters,
W79-07424 5D

ACIDIC WATER
Aluminum Leaching Response to Acid Precipitation: Effects on High-Elevation Watersheds in the Northeast,
W79-07103 2K

ACIDITY
Effects of Soil pH and Moisture on the Direct Radioassay of Herbicides in Soil,
W79-07172 5G

ACOUSTICS
Acoustical Estimation of Zooplankton Populations,
W79-07120 2H

ACQUATIC BACTERIA
Occurrence and Significance of Candida Albicans in Lake Ontario Bathing Beaches,
W79-07207 5C

ACRYLIC LYSIMETERS
Leachability of Radioactive Constituents from Uranium Mine Tailings Status Report (June, 1974 to January, 1977),
W79-07201 5D

ACTIVATED CARBON
Studies on the Biological Regeneration of Activated Carbon,
W79-07005 5D

Carbon Treatment of Otto Fuel Wastewater - A Laboratory Study,
W79-07045 5D

Investigation into the Application of Physico-Chemical Processes for Municipal Waste-Water Treatment (Onderzoek Naar de Toepassingsmogelijkheden van Fysisch-Chemische Processen Voor de Zuivering van Huishoudelijk Afvalwater),
W79-07071 5D

ACTIVATED SLUDGE
Operational Control Procedures for the Activated Sludge Process - Appendix,
W79-07030 5D

Laboratory and Pilot Plant Evaluation of Intermittent Loading on Small-Scale Extended Aeration Biological Systems,
W79-07039 5D

Pollution from Major Municipal Waste Sources in Dade County, Florida,
W79-07054 5D

Operational Control Procedures for the Activated Sludge Process. Part III-B. Calculation Procedures for Step-Feed Process Responses,
W79-07058 5D

Single Sludge Nitrogen Removal Systems,
W79-07219 5D

ACTIVATION ENERGY
The Effect of Temperature on Specific Growth Rate and Activation Energy of Microcystis and Synechococcus Isolates Relevant to the Onset of Natural Blooms,
W79-07183 5A

ADENOSINE TRIPHPOSPHATE (ATP)
Application of the ATP Assay for Monitoring the Disinfection of Wastewater Streams,
W79-07203 5D

ADIRONDACKS (NY)
Aluminum Leaching Response to Acid Precipitation: Effects on High-Elevation Watersheds in the Northeast,
W79-07103 2K

ADMINISTRATIVE AGENCIES
National Wildlife Federation Interim Survey of EPA 201 Wastewater Treatment Facility Grant Program Documents Land Use Impacts, NEPA Compliance and Public Participation (January 1-March 31, 1976,
W79-07052 6G

Water Quality Standards,
W79-07239 6E

The Arizona Water Resources Committee: An Historical Perspective,
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Implementation of Executive Order 11988 on Floodplain Management,
W79-07267 6E

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- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
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VOLUME 12, NUMBER 16
AUGUST 15, 1979

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he Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the ansaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
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05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews

SUBJECT INDEX

AUTHOR INDEX

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

A STATISTICAL VIEW OF A CLASS OF WATER QUALITY INDICES,
Geological Survey, Reston, VA. Water Resources Div.
J. M. Landwehr.
Water Resources Research, Vol. 15, No. 2, p 460-468, April 1979. 10 fig, 2 tab, 26 ref.

Descriptors: *Water quality, *Indexing, *Statistical methods, Methodology, Water types, Water chemistry, *Water quality indices.

Water quality indices are treated as random variables; the class of quality 'averaging' indices is examined and several statistics are derived. The probability density functions of the water quality constituents and the structure of the transform functions (rating curves) influence the ability of indices to measure policy performance. (Woodard-USGS)
W79-07708

THE DEPENDENCE OF DEWATERING PROCESS ON AQUEOUS PROPERTIES OF SLUDGES,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidro-geologii, Gostroy (USSR).
L. G. Pirogov.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 144-147, 1975. 6 tab.

Descriptors: *Dewatering, *Equations, *Sludge, *Physical properties, Osmosis, Filtration.

An investigation of the dependence of dewatering on the aqueous properties of sludges was carried out using the works of P. A. Rebinder, A. V. Likov, and M. P. Kazansky. Osmotically combined water was separated into two types: osmotic proper and entrapped water. When entrapped water is included in the Rebinder classification category, a uniform method for the calculation of physical constants related to water balance, structural and filtration characteristics, and sludge thickening, was developed. Equations and actual calculated values are presented for these physical characteristics. (See also W79-07825) (Small-FRC)
W79-07841

SPRINGS OF FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.; and Florida Bureau of Geology, Tallahassee.
J. C. Rosenau, G. L. Faulkner, C. W. Hendry, Jr., and R. W. Hull.
Florida Bureau of Geology Bulletin No 31 (revised), 1977. 461 p, 31 fig, 7 tab, 91 ref.

Descriptors: *Florida, *Springs, *Discharge(Water), *Spring waters, *Water quality, Artesian wells, Water utilization, Recreation, Scuba diving, Aquifer characteristics, Hot springs, Thermal water, Geohydrologic units, Karst, Caves, Submarine springs, Limestones, Aerial photography, Data storage and retrieval, *Springs inventory.

Florida's 27 first magnitude springs discharge more than 6 billion gallons per day from Tertiary limestone of the Floridan aquifer. Based on an inventory of about 300 springs, estimated total ground water discharge from Florida's springs averages 8 billion gallons per day, or more than twice the amount of fresh ground water pumped in Florida in 1975. The major use of the springs is recreational. Neither use nor spring flow has changed significantly in the past 30 years. A few springs in the populous southern part of the State no longer flow, or their flows have been reduced, owing to increased water use. Florida's springs are concentrated along the major streams and west coast. There are many submarine and some pseudosprings. At least 50 springs are known along the Suwannee River and its tributaries, of which 9 are first magnitude springs having average flows of more than 65 million gallons per day. The report describes the springs, their water quality, and flow rates. Photographs and maps are included and each spring is located geographically and by latitude and longitude. (Woodard-USGS)
W79-07946

2. WATER CYCLE

2A. General

CHEMICAL CHARACTERISTICS OF SMALL STREAMS NEAR HANEY IN SOUTHWESTERN BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 2K.
W79-07540

EVOLUTION AND TESTING OF A FIVE-DAY WATER YIELD MODEL,
Clemson Univ., SC. Dept. of Agricultural Engineering.
T. V. Wilson, J. T. Ligon, and A. G. Law.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 298-303, March-April 1979. 11 fig, 4 tab, 5 ref.

Descriptors: *Water yield, *Watersheds(Basins), *Model studies, *Mathematical models, Runoff, Precipitation(Atmospheric), Rainfall-runoff relationships, Hydrographs, Flow, Analytical techniques, Hydrology, Parameters.

The water yield model developed at the Southeast Watershed Laboratory was used on 10 watersheds representing 3 physiographic provinces in an effort to test its adaptability to different watershed characteristics. In each case, the analysis mode was used to obtain optimized values for the 11 parameters using 5-day values of precipitation and runoff. For one watershed, each parameter (a group of 5 in one case) was varied individually through a range of 1/4 to 4 times its converged value to study the influence of single parameter variation. This process indicated that 1/2 to 2 times the converged parameters do not drastically alter the results of prediction. Some attempts were made to determine parameter differences on watersheds of different physiographic regions, but an insufficient number of watersheds was used to effectively relate physical watershed characteristics with parameters. Water yield predictions using converged parameters and averaged parameters (across 12 four-year watershed-periods) were made, plotted, and compared. Simulation results were good with converged parameters; peaks, recessions, low flows, and total yields matched well. With averaged parameters, total 4-year yields ranged from 69.6 to 127.8% observed flow. Peaks, recessions, and low flow were not as well matched, although qualitatively the shape of the hydrgraph was well reproduced. (Sims-ISWS)
W79-07556

SIMULATION OF ARID RANGELAND WATERSHED HYDROLOGY WITH THE USDAHL-74 MODEL,
Science and Education Administration, Boise, ID. Northwest Watershed Center.
C. L. Hanson.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 304-309, March-April 1979. 7 fig, 4 tab, 9 ref.

Descriptors: *Soil water, *Runoff, *Model studies, *Mathematical models, *Idaho, Ranges, Arid lands, Arid climates, Precipitation(Atmospheric), Rainfall, Snowfall, Snowmelt, Infiltration, Soils, Geology, Land use, Grazing, Vegetation, Watersheds(Basins), Hydrology.

The USDAHL-74 revised model of watershed hydrology was evaluated on an 83-ha arid rangeland watershed in southwest Idaho. The model simulated soil water adequately, except during periods in late summer and fall. Simulated runoff indicated that the model responded primarily to precipitation intensity; however, measured watershed runoff responded primarily to precipitation amount and not as much to intensity. (Sims-ISWS)
W79-07557

HYDROLOGIC EFFECTS OF BRUSH CONTROL ON TEXAS RANGELANDS,
Science and Education Administration, Temple, TX.
C. W. Richardson, E. Burnett, and R. W. Bovey.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 315-319, March-April 1979. 3 fig, 3 tab, 8 ref.

Descriptors: *Brush control, *Vegetation effects, *Runoff, *Texas, *Southwest U.S., On-site investigations, Ranges, Mesquite, Rainfall, Drainage, Effects, Soil moisture, Soil water, Watersheds(Basins), Evapotranspiration, Vegetation, Herbicides, Hydrology.

Noneconomic brushy vegetation infests millions of acres of rangeland in the Southwestern United States. This investigation was conducted to determine the hydrologic effects of controlling the brush chemically or mechanically. In the Blackland Prairie of Texas, two small watersheds infested with honey mesquite were selected for this study. The mesquite on one watershed was killed with chemicals. Killing the mesquite reduced evapotranspiration about 8 cm per yr and increased surface runoff about 10%. In the Edwards Plateau of Texas, two watersheds infested with brush were used to determine the hydrologic effects of mechanical methods of brush control. Root plowing to remove the brush on one watershed reduced surface runoff about 20%. (Sims-ISWS)
W79-07558

'ARIMA' PROCESSES FOR HYDROMETEOROLOGICAL FORECASTING AND SIMULATION (LES PROCESSUS DU TYPE 'ARIMA' POUR LA PREVISION ET LA SIMULATION EN HYDROMETEOROLOGIE),
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. W. Delleur.
La Houille Blanche No. 6. p 391-400, 1978. 7 fig, 2 tab, 16 ref. (English summary). OWRT B-036-IND (19).

Descriptors: *Weather forecasting, *Runoff forecasting, *Stochastic processes, Simulation analysis, Synthetic hydrology, ARIMA, Hydrometeorology.

'ARIMA' stochastic process models are combinations of autoregressive models and movable averages over random independent variables. Their flexibility allows simulation of the random structures of stationary or non-stationary chronological hydrometeorology records. Their application is facilitated by routine model identification, estimation and test methods. Applications of 'ARIMA' models for description of monthly rainfall and both monthly and annual runoff in a certain number of catchments in the central United States are discussed. An example is given of the use of such models for forecasting runoff from forecast rainfall data.
W79-07583

EFFECTS OF A BARRIER ON TEMPERATURE STRUCTURE AND MIXING IN THERMALLY STRATIFIED WATER COOLED FROM ABOVE,
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.
R. Viskanta, A. Karalis, and M. Behnia.
Warme- und Stoffubertragung, Vol. 11, p 229-239, 1978. 8 fig, 1 tab, 18 ref. OWRT B-077-IND(3).

Descriptors: *Heat transfer, *Convection, *Cooling, *Stratification, Heat flow, Energy transfer, Temperature, Thermocline, Interferometry, Mach-Zehnder Interferometer.

A Mach-Zehnder interferometer was used to study the unsteady temperature structure in radiation

stratified water cooled from above. Temperature distribution measurements in a test cell filled with distilled water provide conclusive evidence that the thermal structure between the air-water interface and the stable region is controlled by buoyancy induced natural convection. The cooling from above produces a complex vertical temperature profile which can be divided into several distinct regimes. Introduction of a thin, rigid transparent (glass) plate into the water before thermal stratification by radiation and cooling confines the natural convection driven flow and reduces the intensity of mixing. As a result, the energy transport from the interior of the water layer to the interface is decreased. However, under the experimental conditions tested use of rigid, horizontal plates introduced in the fluid was not very effective in reducing the transport of heat from the warm interior to the cooler interface.
W79-07584

FREE CONVECTION IN THERMALLY STRATIFIED WATER COOLED FROM ABOVE,
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.
M. Behnia, and R. Viskanta.
International Journal of Heat Mass Transfer. Vol. 22, p 611-623, 1979. 11 fig, 1 tab, 30 ref. OWRT B-077-IND(4).

Descriptors: *Heat transfer, *Convection, *Cooling, *Stratification, Heat flow, Energy transfer, Temperature, Thermocline, Interferometry, Mach-Zehnder Interferometer.

The thermal and fluid kinetics of the convective layer during cooling from the free surface of a thermally stratified water by convection, latent energy transport, and radiation is studied. Laboratory experiments were performed and a Mach-Zehnder interferometer was used to measure the unsteady temperature distribution in a test cell filled with water which was previously stratified. A simple mathematical model based on a thermal energy balance is developed to predict the thickness and the mean temperature of the layer. The model predictions agreed to within 10% with the data from controlled laboratory experiments. It was found that the numerical solution to the model equations agree better with the experimental data than those based on the closed form analytical solution using the constant average surface heat flux. It was determined that the surface boundary condition and the internal physical processes of mixing and entrainment must be better understood in order to model the dynamics of the mixed layer in natural waterbodies.
W79-07585

A GEOHYDROLOGIC OVERVIEW FOR THE PECORA SYMPOSIUM FIELD TRIP, JUNE 1979,
Geological Survey, Huron, SD. Water Resources Div.
N. C. Koch.
Geological Survey open-file report 79-563, May 1979. 19 p, 3 fig, 6 ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Hydrogeology, *South Dakota, Aquifer characteristics, Water wells, Water yield, Streamflow, Precipitation(Atmospheric), Lakes, *Big Sioux River basin(S Dak).

The settlement and development of South Dakota and the Big Sioux River basin have been closely related to water resources. The climate is a continental type and annual precipitation in the basin is about 23 inches. The area of the field trip lies within the Coteau des Prairies, a massive highland within the Central Lowlands Province. It is drained primarily by the Big Sioux River. The bedrock underlying the coteau is a series of Cretaceous sedimentary rocks and the Sioux Quartzite of Precambrian age. Wells in the Cretaceous Dakota Sandstone yield from 10 to 1,000 gallons per minute; the other bedrock formations generally yield less than 10 gallons per minute. The glacial outwash deposits on the coteau are generally excellent sources of ground water; the other glacial deposits, till and loess, are not dependable sources. (Woodard-USGS)
W79-07699

A PHYSICALLY BASED, VARIABLE CONTRIBUTING AREA MODEL OF BASIN HYDROLOGY,
Institute of Hydrology, Wallingford (England).
K. J. Beven, and M. J. Kirkby.
Hydrological Sciences Bulletin, Vol. 24, No. 1, p 43-69, March 1979. 16 fig, 1 tab, 36 ref.

Descriptors: *Watersheds(Basins), *Hydrology, *Model studies, *Hydrological aspects, Analytical techniques, Hydrologic properties, Areal, Infiltration, Mathematical models, Soil moisture, Saturated soils, Routing, Channels, Spatial distribution, Overland flow, Calibrations, Interception, Foreign research, On-site tests, Runoff, *Great Britain, Sub-basin model.

A hydrological forecasting model was presented that attempts to combine the important distributed effects of channel network topology and dynamic contributing areas with the advantages of simple lumped parameter basin models. Quick response flow is predicted from a storage/contributing area relationship derived analytically from the topographic structure of a unit within a basin. Average soil water response was represented by a constant leakage infiltration store and an exponential subsurface water store. A simple, non-linear routing procedure related to the link frequency distribution of the channel network completes the model and allows distinct basin sub-units, such as headwater and sideslope areas to be modelled separately. The model parameters are physically based in the sense that they may be determined directly by measurement and the model may be used at ungauged sites. Procedures for applying the model and tests with data from the Crimple Beck basin were described. Using only measured and estimated parameter values, without optimization, the model makes satisfactory predictions of basin response. The modular form of the model structure should allow application over a range of small and medium sized basins while retaining the possibility of including more complex model components when suitable data are available. (Humphreys-ISWS)
W79-07753

EFFECTS OF CHANNEL ENLARGEMENT BY RIVER ICE PROCESSES ON BANKFULL DISCHARGE IN ALBERTA, CANADA,
Calgary Univ. (Alberta). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W79-07756

ON THE INFLUENCE OF THE SPATIAL DISTRIBUTION OF RAINFALL ON STORM RUNOFF,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 2B.
W79-07765

THE ZOOGEOGRAPHY OF THE FRESHWATER FISHES OF THE POTOMAC RIVER BASIN,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
J. R. Stauffer, Jr., C. H. Hocutt, and D. S. Lee.
Interstate Commission on the Potomac River Basin, Rockville MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T, Eds., 1978. p 44-54, 2 fig, 61 ref.

Descriptors: *Freshwater fish, *Fish migration, *Fish populations, *Fish establishment, *Geologic history, *Potomac River, River systems, Drainage patterns(Geologic), Watersheds(Divides).

The Potomac River is part of a transition area between the northern Atlantic slope drainages, characterized by few native species and endemics, and the more rich southern Atlantic slope drainages. Presently 78 species and one endemic are known from the Potomac. The Potomac is the northern range limit for Phoxinus areas, Nocomis leptocephalus, and Moxostoma rhothoecum, and the southern limit for Notropis s. spilopterus, Pimephales notatus, Semotilus m. marginata, Percopsis omiscomaycus, and Percina caprodes. Etheostoma caeruleum is known only to the Potomac on the Atlantic slope. Northern forms of Potomac fauna entered through stream captures with the Susquehanna River, but because of the similarity of the fauna of both basins, no specific cases are documented. Ohio River fishes most likely entered through captures with the Monongahela River basin. An exchange between the Potomac and Roanoke-Teays system through the James is indicated by the presence of Moxostoma rhothoecum. The Atlantic coastal plain endemics found in the Potomac most likely dispersed into and from the Potomac through the prevalent, low-lying, interconnecting streams and ditches. The species introduced into the Potomac have been subdivided into Old World species and transplants, which are those native to North America. Three species are no longer found in the Potomac and one, Acipenser brevirostrum, is on the Federal threatened and endangered list. (Davison-IPA)
W79-07968

FISHERY RESOURCES AND MANAGEMENT IN WEST VIRGINIA,
West Virginia Dept. of Natural Resources, Romney.
G. E. Lewis.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 55-58, 2 tab, 9 ref.

Descriptors: *Fish, *Fishing, *Fish populations, *Fish establishment, *Aquatic environment, *Aquatic habitats, Sport fish, River systems, Drainage systems, River basins, Watersheds(Basins), Interstate rivers, Potomac River, West Virginia, Creel census.

Nearly half of the cold-water and warm-water fishery resources in West Virginia are in the Potomac River drainage where most of the game fish have been introduced. The three largest streams within the Potomac basin of West Virginia are the Shenandoah, South Branch, and Cacapon Rivers. A shift in the Shenandoah towards species favoring eutrophic situation is attributed to the high levels of nitrogen and phosphorus compounds in waste water from cities, land surface runoff, and organic humus. Fishing is good to excellent for smallmouth bass and sunfish in the Cacapon and South Branch rivers. The West Virginia Department of Natural resources is currently acquiring strategically located sites to facilitate access to the larger streams of the Potomac basin. Stream sediment, particularly heavy in areas being urbanized, has become a source of fish habitat degradation. A demonstration project in stream bank stabilization undertaken by the Fisheries Section of the Division of Wildlife to combat sediment transport has shown encouraging results. The diversity of physiographic features of some of the streams of the Potomac drainage in West Virginia made them potential additions to the National Wild and Scenic Rivers system. (Davison-IPA)
W79-07969

REDUCING THE COST OF CONTINUOUS HYDROLOGIC-HYDRAULIC SIMULATION,
Donohue and Associates, Inc., Waukesha, WI.
S. G. Walesh, and D. F. Snyder.
Water Resources Bulletin, Vol. 15, No. 3, p 644-659, June 1979. 5 fig, 3 tab, 11 ref.

Descriptors: *Computers, *Simulation analysis, *Continuous models, *Water quality, *Hydrology, *Hydraulics, *FRIT technique, Watersheds(Basins), Wisconsin, Meteorology, Cost reductions, Flood water storage, Land use changes, Channel modification, Discrete events, Discharge-frequency relations, Effects, Probability, Systems analysis.

The use of continuous hydrologic-hydraulic-water quality models is inhibited by their large computer run costs relative to cost incurred with discrete event models. The fixed recurrence interval transfer (FRIT) technique is a means of achieving substantial reductions in computer costs associated with continuous models while retaining their technical advantages. The FRIT technique is applicable where it is reasonable to assume that the recurrence interval of the response of a watershed to a causative meteorologic event is the same for both 'before' and 'after' conditions. Example applications of FRIT to the hydrologic-hydraulic modeling of floodwater storage, land use changes, and channel modifications are presented to demonstrate the procedure, to suggest the expected accuracy, and to illustrate how computer run costs might be reduced by 99% or more. The FRIT technique is intended for preliminary assessment of the impact of alternative land use conditions and structural water control measures. (Bell-Graf--Cornell)
W79-07998

2B. Precipitation

ANNUAL PRECIPITATION IN THE NORTHEAST UNITED STATES: LONG MEMORY, SHORT MEMORY, OR NO MEMORY,
Pennsylvania State Univ., University Park. Dept. of Geosciences.
K. W. Potter.
Water Resources Research, Vol. 15, No. 2, p 340-346, April 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Precipitation(Atmospheric), *Climatology, *Statistics, *Northeast U.S., Climatic data, Analytical techniques, Data processing, Statistical methods, Homogeneity, Annual, Time series analysis, Correlation analysis, Rainfall, Snowfall, Streamflow, Meteorology, Autocorrelation analysis.

Regional filtering and intervention analysis of nineteen 100-year precipitation series from the northeast United States indicated that 8 of these series are of doubtful homogeneity. Statistics of these series were generally distorted. Of particular significance is the inflation of the short-lag autocorrelation function and Hurst coefficient. For the precipitation series which appear to be homogeneous, the estimated autocorrelation functions and Hurst coefficients are remarkably consistent with a lag 1 autoregressive process, indicating that annual precipitation in the northeast United States is a short-memory process. Based on these results, it was recommended that before long-term memory is inferred from analyses of hydrologic series, the homogeneity of these series should be clearly established. (Sims-ISWS)
W79-07555

USE OF SPECIFIC CONDUCTANCE AND CONTACT TIME RELATIONS FOR SEPARATING FLOW COMPONENTS IN STORM RUNOFF,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
D. H. Pilgrim, D. D. Huff, and T. D. Steele.
Water Resources Research, Vol. 15, No. 2, p 329-339, April 1979. 7 fig, 23 ref.

Descriptors: *Storm runoff, *Base flow, *Dissolved solids, On-site investigations, Flow, Specific conductivity, Runoff, Soil water, Subsurface flow, Surface runoff, Soil water, Sampling, Data processing, Analytical techniques, Solids contact processes, Contact time.

The difference between the dissolved-solids concentrations in base flow and in storm flow has often been used as the basis for separating components of flow. However, an analysis that explicitly relates the amount of time that runoff water has been in contact with watershed soils to the resulting dissolved-solids concentration showed that simple mass balance chemistry methods for hydrograph separation are misleading. Field studies of surface and subsurface storm flow, when coupled with laboratory determination of the relationship between contact time and dissolved solids content of a soil water mixture, suggested that the residence time of infiltrated water is as short as a few hours in the cases studied. In those cases, hydrograph separation methods based on the simple mass balance equation for the dissolved solids will yield considerable overestimates of the base flow component. (Sims-ISWS)
W79-07764

ON THE INFLUENCE OF THE SPATIAL DISTRIBUTION OF RAINFALL ON STORM RUNOFF,
Corps of Engineers, Washington, DC.
C. B. Wilson, J. B. Valdes, and I. Rodriguez-Iturbe.
Water Resources Research, Vol. 15, No. 2, p 321-328, April 1979. 6 fig, 2 tab, 8 ref. NWS 4-36738.

Descriptors: *Rainfall, *Runoff, *Storm runoff, *Model studies, Mathematical models, Spatial distribution, Isohyets, Mapping, Hydrographs, Discharge(Water), Streams, Rainfall-runoff relationships, Watersheds(Basins), Networks, Rain gages, Meteorology.

This study was an assessment of the importance of precipitation accuracy on the rainfall-runoff modeling of a small catchment. Two mathematical models were used in the investigation: a deterministic rainfall-runoff model based on the kinematic wave approximation and a nonstationary time-varying multi-dimensional rainfall generation model. It was implicitly assumed that this rainfall generation model is an appropriate mathematical representation of the natural phenomenon of rainfall. The deterministic rainfall-runoff model was used to represent the 26.5 sq mi catchment of the Rio Fajardo in northeastern Puerto Rico. The rainfall model generates synthetic rainfall which serves as the input to this runoff model. The influence of the spatial distribution of the rainfall input on the discharge was analyzed by using 1 rain gage or 20 rain gages to record the synthetic storms. The isohyetal maps and hyetographs of the synthetic storms, together with the storm hydrographs produced by the runoff model, were analyzed, with specific attention given to the volume of storm runoff, time-to-peak runoff, and peak runoff. The experiments showed that the spatial distribution of rain and the accuracy of the precipitation input have a marked influence on the outflow hydrograph from a small catchment. (Sims-ISWS)
W79-07765

AN INVESTIGATION INTO THE EFFECT OF STORM TYPE ON PRECIPITATION IN A SMALL MOUNTAIN WATERSHED,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
W. J. March, J. R. Wallace, and L. W. Swift, Jr.
Water Resources Research, Vol. 15, No. 2, p 298-304, April 1979. 1 fig, 6 tab, 18 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Storms, *Model studies, *Appalachian Mountain region, Mathematical models, Evaluation, On-site data collections, Watersheds(Basins), Forest watersheds, Mountains, Mountain forests, Networks, Rain gages, Data processing, Meteorology.

A set of regression equations relating storm rainfall depth to watershed topography and storm type was derived for the high-density precipitation network at Coweeta Hydrologic Laboratory. The most general equation predicted storm amounts for an independent test group of gages with an average error of 0.38 cm (0.15 inches). The dependent variables was the ratio of the rainfall at each site to the rainfall at a base gage. Predictive variables were topographic slope, aspect, ground elevation at the gage site, and smoothed elevation. The smoothed elevation, which is the elevation the gage would assume if it were on a smooth plane representing the general topography of the terrain, appeared in more equations than any other variable. One equation was calculated for each of 6 identified storm types, and one equation was calculated with all storms considered together. Overall, the equations which considered storm type were not better predictors of site rainfall than the equation which did not consider storm type. Predictions of storm amounts were closest to measured amounts for storms where the low-pressure center passed east of Coweeta, while the predictions for the air-mass or thunderstorm type had the greatest errors. The prediction errors of the equations for warm-, cold-, and stationary-front storm types were intermediate. The small number of tropical storms limited development and testing of equations for that type. (Sims-ISWS)
W79-07767

2C. Snow, Ice, and Frost

THE APPLICATION OF AERIAL AND SATELLITE SNOW-MAPPING TECHNIQUES FOR MULTI-PURPOSE RESERVOIR SYSTEM OPERATIONS IN ARIZONA,
Salt River Project, Phoenix, AZ; and Geological Survey, Phoenix, AZ. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-07695

PERIODIC SURGING OF THE ANTARCTIC ICE SHEET--AN ASSESSMENT BY MODELING,
Melbourne Univ., Parkville (Australia). Antarctic Div.
W. F. Budd, and B. J. McInnes.
Hydrological Sciences Bulletin, Vol. 24, No. 1, p 95-104, March 1979. 7 fig, 2 tab, 16 ref.

Descriptors: *Ice, *Surges, *Model studies, *Antarctic, Movement, Glaciers, On-site investigations, Velocity, On-site data collections, Physical properties.

A numerical model has been developed which simulates surging in certain glaciers and ice sheets in an apparently realistic manner. This model has been found to give small mountain glaciers to large sectors of ice caps. The model reproduces realistically many features of these ice masses such as the period of the surge, the duration, the velocity of advance, the magnitude of the advance, and the changes in ice thickness. The application of the model to the Antarctic ice sheet is made more difficult by the problem caused by the temperature dependence of the flow properties of ice. This means that for a complete study the interaction with the environment needs to be considered. However, at this stage preliminary calculations indicate a number of features that are relevant to the effect of Antarctic ice surges on the global climate. These include the period between surges, the duration of the surge, the amount of ice advanced and the changes in thickness of the ice sheet. (See also W75-03085 and W75-08713) (Humphreys-ISWS)
W79-07751

EFFECT OF SURFACE MELTWATER ACCUMULATION ON THE DISSIPATION OF LAKE ICE,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. Wake, and R. R. Rumer.
Water Resources Research, Vol. 15, No. 2, p 430-434, April 1979. 8 fig, 2 tab, 13 ref. NOAA 03-6-022-352636.

Descriptors: *Lake ice, *Melting, *Boundary processes, *Model studies, Melt water, Ice, Air-water interfaces, Mathematical models, Heat balance, Albedo, Heat transfer, Analytical techniques, Solar radiation, Air-ice interface.

The rate of ice melt with and without water accumulation on the ice surface was computed based on the interfacial heat exchange processes, the thermal diffusion of heat through the accumulated water, and the internal absorption of solar radiation. Although the accumulated water does increase the net absorbed solar radiation due to reduced albedo, the resulting air-water interface temperature was found to be considerably greater than 0C, thereby decreasing the net long-wave, sensible, and evaporative heat inputs. The findings indicated that the overall effect of accumulated water on ice melt

may not be quite as large as expected from albedo differences alone. The often used bare ice assumption is still believed to serve as a good engineering approximation. More study is needed to relate the vertical thermal diffusivity to such factors as wind effects, gravitational stability, and water depth. Verification would be difficult in the field, but laboratory experimentation seems possible. (Humphreys-ISWS)
W79-07759

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION COMPUTED TO ESTIMATE LEACHING FRACTIONS,
Science and Education Administration, Grand Junction, CO.
D. C. Kincaid, E. G. Kruse, H. R. Duke, and D. F. Champion.
Transactions of The American Society of Agricultural Engineers, Vol. 22, No. 2, p 310-319, March-April 1979. 4 fig, 3 tab, 10 ref.

Descriptors: *Evapotranspiration, *Leaching, *Irrigation, *Colorado, Model studies, Simulation analysis, Reclamation, Soils, Winds, Dew point, Vapor pressure, Wind velocity, Equations, *Leaching fractions, *Potential evapotranspiration, *Grand Valley(CO), Soil heat flux, Saturation vapor pressure.

The United States Department of Agriculture Irrigation Scheduling Program with a Penman-type potential evapotranspiration equation was used as a simulation model to compute daily water use and deep percolation amounts on several sprinkler and furrow irrigated sites in the Grand Valley of Colorado. Input included daily weather data from one site and measured water applications on each site for the 1976 irrigation season. Leaching fractions of 0 to 0.1 were determined for a sprinkler irrigated field. For furrow irrigated sites, average seasonal leaching fractions of 0.28 and 0.51 were computed for the low and high intake rate soils, respectively. Furrow intake measuremets and computed deep percolation amounts indicated that about 1/2 of the seasonal leaching occurred following the first irrigation. (Roberts-ISWS)
W79-07546

WIND PROFILE PARAMETERS AND TURBULENCE INTENSITY OVER SEVERAL ROUGHNESS ELEMENT GEOMETRIES,
Science and Education Administration, Manhattan, KS.
L. Lyles, and B. E. Allison.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 334-338, 343, March-April 1979. 3 fig, 4 tab, 15 ref.

Descriptors: *Winds, *Wind erosion, *Evaporation, *Soils, Soil water, Soil moisture, Particle size, Profiles, Wind velocity, Roughness coefficient, Turbulence, Velocity, Model studies, Mathematical models.

Estimating equations were developed for the mean velocity profile parameters in the logarithmic law and for longitudinal turbulence intensity. The estimates were based on wind tunnel measurements over several roughness element shapes, sizes, heights, and geometrical patterns. All the prediction equations had correlation coefficients greater than 0.90. These equations have application in wind erosion of soil particles, water evaporation, and transport of gases. They only apply to a particular set of conditions, which indicates a need for more universally applicable equations for the profile parameters and turbulence intensity. (Sims-ISWS)
W79-07547

AN ADVECTION-ARIDITY APPROACH TO ESTIMATE ACTUAL REGIONAL EVAPOTRANSPIRATION,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
W. Brutsaert, and H. Stricker.
Water Resources Research, Vol. 15, No. 2, p 443-450, April 1979. 9 fig, 34 ref.

Descriptors: *Evapotranspiration, *Meteorological data, *Model studies, Advection, Evaporation, Atmosphere, Energy budget, Droughts, Watersheds(Basins), Soil moisture, Equations, Mathematical studies, Regions, Measurement, *Regional evapotranspiration, *Potential evaporation, Symmetry, Conceptual model, Regional advection, Evaporative power, Atmospheric conditions, Energy budget method, Severe drought.

Actual regional evapotranspiration was calculated by means of a procedure requiring only meteorological data, which are those data commonly used in the various versions of the combination approach for potential evaporation. The approach was based on a conceptual model involving, first, the effect of regional advection on potential evaporation, and second, an assumed symmetry between potential and actual evaporation with respect to the evaporative power of the air in the absence of advection. Thus, the degree of nonavailability of water for evapotranspiration, that is the aridity of the region, was deduced from the regional advection of drying power of the air, as implied by the atmospheric conditions. The approach was found to give good agreement with daily data of evapotranspiration obtained by means of an energy budget method for a period of severe drought in a rural watershed in a sandy region. One of the advantages is that no soil moisture data, no stomatal resistance properties of the vegetation, nor any other additional aridity parameters are required to determine actual evapotranspiration. (Roberts-ISWS)
W79-07548

POTENTIAL EVAPORATION--SIGNIFICANCE AND MEASUREMENT,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
F. I. Morton.
In: Hydrology Research Division, Annual Progress Reports and Short Research Notes, 1977-78, p 5-13, 1979. 5 fig, 1 tab, 9 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. GW 68-8.

Descriptors: *Evapotranspiration, *Computer models, *Lakes, Climatic data, Computer programs, Temperature, Atmospheric pressure, Dew point, Climatology, Evaporation, Solar radiation.

The model described for estimating areal evapotranspiration is a modification of an earlier model, and provides estimates of lake evaporation from routine climatological observations in the land environment. Required input lake characteristics are latitude, altitude (or average atmospheric pressure), and an estimate of average annual precipitation. Require data inputs are monthly air temperatures, dew point temperatures, and the ratios of observed to maximum possible sunshine duration made in land or lake environments. The model, programmed in Fortran for the Hewlett-Packard 9100 A-9101 A desk calculator and the Hewlett-Packard pocket calculator, is designed for use anywhere in the world. The lake evaporation estimates, sensitive to errors in the sunshine duration inputs, are relatively insensitive to errors in the air temperature and dew point temperature inputs in comparison with areal evapotranspiration estimates. Seasonal changes in subsurface heat storage are not taken into account, and the model cannot provide realistic monthly evaporation estimates from deep lakes. Model estimates of annual lake evaporation are plotted against corresponding water budget estimates for Lake Hefner, Oklahoma; the Salton Sea and Silver Lake in California; Pyramid and Winnemucca Lakes in Nevada; Lake Ontario; and Dauphin Lake in Manitoba. Monthly average values for model estimates of evaporation and the water budget estimates are tabulated for Pyramid and Winnemucca Lakes. The maps provided show the average annual lake evaporation and the average annual or areal evapotranspiration in Canada and the United States. (Davison-IPA)
W79-07955

2E. Streamflow and Runoff

DRAINAGE EVOLUTION AND FISH DISPERSAL IN THE CENTRAL APPALACHIANS: SUMMARY,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
C. H. Hocutt.
Geological Society of America Bulletin, Part I, Vol. 90, p 129-130, February 1979. 1 fig, 4 ref.

Descriptors: *Fish migration, *Geologic history, *Pleistocene epoch, *Rivers, *Drainage, *Drainage effects, Aquatic habitats, Fish barriers, Drainage patterns(Geologic), Drainage systems, History.

Evidence indicates that the Appalachian Plateau once extended eastward to the present-day divide between the Greenbriar and James Rivers along Allegheny Mountain. During Pliocene time this extended plateau was drained by the Gauley River. Glacial ponding occurred in the Teays drainage during the Pleistocene, facilitating the dispersal of certain fish species and inhibiting the dispersal of others. Fish migrated up Teays River along the shoreline of glacial Lake Tight to negotiate the Kanawha Falls area. There, the fishes found the strenuous Gauley River route less difficult than the evolving Teays-New River gorge. Concurrently, during the Pleistocene, Greenbriar River breached a major divide between it and Old Gauley, rapidly extending its drainage along a limestone belt. At this time faunal exchanges occurred along the Gauley-Greenbriar interface which may have facilitated the dispersal of Teays stock to the Atlantic slope through bypassing the Teays gorge. A map of the area is provided. (Davison-IPA)
W79-07510

L.N. FAN'S DATA ON BUOYANT JETS IN CROSSFLOW,
McGill Univ. (Montreal). Dept. of Civil Engineering and Applied Mechanics.
For primary bibliographic entry see Field 8B.
W79-07536

OPTIMAL DESIGN OF CULVERTS UNDER UNCERTAINTIES,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14572, p 443-460, May 1979. 6 fig, 4 tab, 13 ref, 2 append. NSF ENG78-05449.

Descriptors: *Culverts, *Design, *Optimization, *Model studies, Mathematical models, Computer models, Probability, Statistics, Structures, Highways, Hydraulic structures, Flood damage, Risks, Water resources, Hydraulics, Hydrology, Civil engineering, Uncertainty principle, Optimal design.

In the design of highway drainage culverts there are many uncertainties involved in addition to the normally considered hydrologic uncertainty due to the randomness in flood and rainfall frequencies. Uncertainties can be contributed from many sources and are classified as hydrologic, hydraulic, structural, and economic with subtypes of uncertainties in each of these categories. This paper described a procedure for systematically analyzing and incorporating the uncertainties into the optimal design of drainage culverts. The procedure was based upon the concepts of hydrologic risk, first-order analysis of uncertainties, evaluation of expected damages, and optimization. The optimization model was used to select the magnitudes of the design variables in order to minimize total expected project costs. Using such a design procedure, the proper trade-off analysis among the potential flood damages, the design uncertainties, and the cost of the project was performed in determining the design. (Sims-ISWS)
W79-07549

FLOW RESISTANCE IN COBBLE AND BOULDER RIVERBEDS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

D. B. Simons, K. S. Al-Shaikh-Ali, and R-M. Li.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14576, p 477-488, May 1979. 12 fig, 12 ref, 2 append.

Descriptors: *Streamflow, *Flow resistance, *Sediments, Beds, Beds under water, River beds, Streams, Rivers, Floods, Flood control, Flood flow, Sands, Gravels, Boulders, Model studies, Hydraulic models, Mannings equation, Channels, Channel flow, Roughness(Hydraulic), Hydraulics.

Field evidence and experimental evidence were presented to demonstrate the importance of the inflow of sand and gravel size sediments on resistance to flow in channels whose beds are primarily cobbles, rocks, and boulders. The released sediments fill the spaces between the larger roughness elements, forcing the channel to behave as a sand bed channel at a much reduced resistance to flow coefficient. Resistance to flow in these channels decreases, resulting in underestimations of: (1) water discharge by a factor of 2; (2) sediment discharge by a factor ranging between 8 and 64; and (3) velocity of flow by a factor of 2. Failure to estimate these quantities with a reasonable degree of accuracy results in the following: (1) underestimation of the actual quantity of available water; (2) improper selection of bank protection material; (3) overestimation of reservoir life; (4) unsafe design of scour depths at hydraulic structures; (5) improper design of location; and (6) others relating to river control and development. (Sims-ISWS)
W79-07550

FLOW CHARACTERISTICS IN TWO-DIMENSIONAL EXPANSIONS,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Dept. of Civil Engineering.
P. R. Mehta.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14579, p 501-516, May 1979. 18 fig, 2 tab, 9 ref, 1 append.

Descriptors: *Flow, *Fluid mechanics, *Flow characteristics, *Flow separation, Model studies, Mathematical models, Numerical analysis, Laboratory tests, Hydraulic models, Turbulence, Viscosity, Shear, Streams, Channels, Walls, Channel flow, Analytical techniques, Hydraulics, Expansion, Asymmetry, Shear flow.

Flow patterns for recirculating flows in sudden two-dimensional expansions were obtained by numerical approaches and experimental studies. Analytical results for low expansion ratio of 1.25 were in good agreement with those of experimental findings. For larger expansion ratios, experimental findings revealed that the flow patterns were asymmetric and unstable. Two distinct types of flow occurred in which the flow characteristics were almost the mirror image of one another in each type of flow. For large expansion ratios, turbulence developed peak values early and also decayed at faster rate after the points of reattachment. Flow attained symmetric conditions earlier for larger expansion ratios. (Sims-ISWS)
W79-07551

COLLIE RIVER UNDERFLOW INTO THE WELLINGTON RESERVOIR,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
B. Hebbert, J. Imberger, I. Loh, and J. Patterson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14593, p 533-545, May 1979. 7 fig, 2 tab, 9 ref, 2 append.

Descriptors: *Reservoirs, *Rivers, *Underflow, *Water quality, *Australia, On-site investigations, Model studies, Mathematical models, Flow, Streamflow, Entrainment, Salinity, Density, Temperature, Water temperature, *Collie River(Australia), *Wellington Reservoir(Australia).

Field data gathered from a Western Australian reservoir were used to obtain an estimate for the entrainment coefficient of the underflowing river. By the use of a steady, normal-flow theory, the entrainment coefficient is related to the flow and river channel characteristics. By combination with a general turbulent entrainment law, it was shown that the entrainment coefficient and dilution may be directly related to the physical characteristics of the river channel, and thus may be estimated without recourse to a field experiment. In order to determine the initial underflow depth and the location of the plunge line, a simple theory using the concept of a normal flow depth was used, the results of which compared favorably with observation. (Sims-ISWS)
W79-07552

INTERACTION BETWEEN MAIN CHANNEL AND FLOOD-PLAIN FLOWS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and R. M. Ahmadi.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14591, p 573-588, May 1979. 12 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Flood flow, *Flood plains, *Open channel flow, Momentum transfer, Flow, River flow, Rivers, Channels, Turbulent flow, Roughness(Hydraulic), Shear stress, Model studies, Hydraulic models, Laboratory tests, Hydraulics, Velocity, Profiles, Hydrology.

The experimental results presented in this paper demonstrated the transport of longitudinal momentum from the main channel to the floodplain. This transport increased the bed shear stress in the floodplain and produced the opposite result on the main channel. The velocity profiles in the region affected by this interaction were found to be similar if viewed with respect to the undisturbed flow in the floodplain. The velocity and length scales were correlated with the ratio of the depth of flow in the main channel to that in the floodplain. In these experiments, the main channel was narrow, and thus the interaction extended inwards to the center line of the main channel. For the concepts introduced in this paper to be used in solving practical problems, further experiments should be conducted with wider main channels, including the effects of bed roughness. (Sims-ISWS)
W79-07553

WAVE RUN-UP INFLUENCE ON OVERTOPPING OF LEVEES,
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
D. H. Keuning, and J. B. M. van Acker.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14588, p 589-604, May 1979. 6 fig, 9 tab, 6 ref, 2 append.

Descriptors: *Levees, *Flood waves, *Winds, *Wave pile-up, Rivers, Flood plains, Model studies, Mathematical models, Stochastic processes, Probability, Floods, Waves(Water), Wind velocity, *Waal River(The Netherlands), *The Netherlands, Overtopping, Wave runup.

A procedure for calculating probabilities of overtopping from the combined occurrence of floods and wave runup with an application to a section of the Waal river in the Netherlands was presented. Annual exceedance probabilities were known for the floods. Runup was computed from wind velocity and wind direction. A stochastic model for these quantities was established, based on a record of 10-yr wind observations. The model was used for generating a series of wind velocities and directions. Combining these sequences with floods, the magnitude of the runup and the probabilities of overtopping for some heights of the levee were computed. The sensitivity of the results with respect to the shape of the flood waves and the simulation models for runup was studied. (Sims-ISWS)
W79-07554

HYDROLOGIC EFFECTS OF BRUSH CONTROL ON TEXAS RANGELANDS,
Science and Education Administration, Temple, TX.
For primary bibliographic entry see Field 2A.
W79-07558

METHODOLOGIES FOR THE DETERMINATION OF FLOW DURATION CURVES AT SPECIFIC SITES ON UNGAGED REACHES OF STREAMS,
Idaho Univ., Moscow. Graduate School.
R. L. Emmert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 397, Price codes: A07 in paper copy, A01 in microfiche. M.S. Thesis, May 1979. 126 p, 50 fig, 27 tab, 18 ref. OWRT A-057-IDA (1), 14-34-0001-9014.

Descriptors: *Flow duration, Streamflow, Hydrologic data, Duration curves, Regional analysis, Hydroelectric power.

This study examines several techniques for synthesizing flow duration curves, at ungaged river sites, for application to hydro-electric energy surveys of entire river systems. Three techniques are presented which can be utilized on natural flowing rivers. Data requirements consist of existing streamflow records and compilations of area-precipitation products. The procedures are based on regression equations and normalization of existing flow duration curves. The three techniques are applied to the Clearwater River in Idaho and a comparison of their results is made. A fourth technique is presented for synthesizing flow duration curves for regulated streams using similar data input as for the three natural flow methods. This procedure is applied to the regulated portions of the Priest and Payette Rivers in Idaho. The Method is also applicable to natural streams and this is illustrated by application to the Clearwater River. Comparisons of synthetic results to actual discharge and energy values for various exceedance percents along with percent differences are presented to give indications of error magnitudes. (Gladwell-Idaho)
W79-07579

JUNCTION LOSSES IN OPEN CHANNEL FLOWS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
J. D. Lin, and H. K. Soong.
Water Resources Research, Vol. 15, No. 2, p 414-418, April 1979. 6 fig, 3 tab, 8 ref. OWRT A-051-CONN (4), 1431-0001-3507.

Descriptors: *Open channel flow, Energy loss, Manning equation, Flow rates, Flow friction, One-dimensional flow, Turbulent mixing, Lateral inflow.

The energy balance of spatially varied flows at the junction of a rectangular open channel and a side channel is investigated by a one-dimensional flow analysis of experimental data obtained from a laboratory channel system. By means of a large control volume enclosing the neighborhood of the junction and having the control surface located at the cross sections where the flow is undirectional, the energy loss can be evaluated. The energy loss is then divided into two components: the boundary friction loss and the turbulent mixing loss. The turbulent mixing loss is found to be of the same order of magnitude as the boundary friction loss evaluated by Manning's formula. The loss coefficient is derived as a function of the ratio of lateral to total flow rate. An energy transfer process from the main channel flow to the lateral inflow or vice versa, which is implicit in the one-dimensional flow analysis, can be analyzed by means of the turbulent mixing loss coefficients. The result may be applied to the calculation of energy losses in the junction or in spatially varied flows with lateral inflow in an open channel flow analysis. (de Lare-Conn)
W79-07582

HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.

C. C. Kidwell.
Geological Survey open-file report 77-732, July 1978. 42 p, 2 fig, 3 tab.

Descriptors: *Hydrologic data, *Streamflow, *Rainfall-runoff relationships, *Retaining walls, *Floodwater, Gaging stations, Discharge(Water), Hydrographs, Mass curves, Flood control, Small watersheds, Texas, *North Creek, *Trinity River basin.

This report contains rainfall and runoff data collected during the 1976 water year for a 21.6-square mile area above the stream-gaging station on North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are used to compute the contents, surface area, inflow, and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations, including hydrographs and mass curves, are included for two storm periods during the 1976 water year at the stream-gaging station. (Woodard-USGS)
W79-07698

NUTRIENT RELATIONSHIPS IN THE DETRITUS OF A TROPICAL SWAMP,
Makerere Univ., Kampala (Uganda). Dept. of Botany.
For primary bibliographic entry see Field 2K.
W79-07736

PERMEABLE WALL EFFECTS ON POISEUILLE FLOW,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. L-F. Liu.
Journal of the Engineering Mechanics Division, American Society of Civil Engineers, Vol. 105, No. EM3, Technical Note, p 470-476, June 1979. 2 fig, 2 tab, 8 ref, 1 append. NY Sea Grant Institute 44-S043-C, 44-S051-C.

Descriptors: *Viscous flow, *Boundaries(Surfaces), *Porous media, *Earth-water interfaces, Permeability, Boundary layers, Theoretical analysis, Analytical techniques, Velocity, Profiles, Hydraulics, Flow, Laboratory tests, Porosity, Boundary processes, Poiseuille flow, Permeable boundary, Two-dimensional flow.

The effects of permeable walls on Poiseuille flow were investigated. Due to the transfer of forward momentum across the permeable interface, a very thin boundary layer region is induced within the porous material adjacent to the interface. The boundary layer structure was found, and it depends strongly on the properties of the material in the boundary regions. The present theory agrees with available experiments very well. However more controlled experimental data are still needed. The results presented can be extended to study the interactions between water waves and seabed, which usually consist of permeable material. Although the unsteadiness becomes one of the new features of these types of problems, the oscillatory laminar (or turbulent) boundary layer above the interface in the free fluid is equivalent to the Poiseuille flows considered in the paper. The boundary layer flow within the permeable material (or seabed) could have significant influence on determining the mass transport velocity under the waves. (Humphreys-ISWS)
W79-07749

THE HYDROLOGICAL RESPONSE OF HEADWATER AND SIDESLOPE AREAS,
Institute of Hydrology, Wallingford (England).
K. Beven
Hydrological Sciences Bulletin, Vol. 23, No. 4, p 419-437, December 1978. 10 fig, 3 tab, 14 ref.

Descriptors: *Basins, *Headwaters, *Rainfall-runoff relationships, Watersheds(Divides), Channels, Storms, Hydrology, Discharge(Water), Peak discharge, Flow, Velocity, *Sideslope areas, Hydrologic response, Convergent headwater, Divergent sideslope.

This paper showed that the hydrological response of convergent headwater and divergent sideslope areas, within a broadly homogeneous basin, may be expected to be significantly different. A field study of 3 headwater and 2 sideslope areas of the order of 0.25 sq km in the Crimple Beck catchment, Yorkshire, England, was described. Spatial variations in gauged rainfall inputs to the sub-basin areas were shown to be small relative to differences in hydrological response. Results from winter and spring storms showed that the headwater areas will generally provide significantly higher and earlier peak flows per unit area and more total storm discharge than the sideslope areas. Areas of surface saturation of the soil are most commonly found during and between storms in convergent hollow areas associated with ephermeral channels, expanding as variable contributing areas of surface flow during storm rainfall. In this basin, however, there was also a tendency for both headwater and sideslope sub-basins to generate surface flow on large areas of saturated soil during storms. Measured unchannelled surface flow velocities were very slow (approximately 20 m/h) and suggested that, in this particular situation, the differences in the response of headwater and sideslope areas may be largely due to the role of the network of minor channels commonly found in convergent headwater areas. These, often ephemeral, channels transmit surface water to the permanent stream network efficiently and rapidly. In the sideslope areas, generally lacking such channels, surface water will be delayed, and may be delayed sufficiently to reinfiltrate before reaching a channel when rainfall ceases. (Lee-ISWS)
W79-07755

EFFECTS OF CHANNEL ENLARGEMENT BY RIVER ICE PROCESSES ON BANKFULL DISCHARGE IN ALBERTA, CANADA,
Calgary Univ. (Alberta). Dept. of Geography.
D. G. Smith.
Water Resources Research, Vol. 15, No. 2, p 469-475, April 1979. 5 fig, 3 tab, 19 ref.

Descriptors: *Channel morphology, *Ice, *Discharge(Water), *Canada, *Australia, *England, *United States, Rivers, Channel flow, Scour, On-site data collections, Analysis, Ice jams, On-site investigations, Frequency, Stream erosion, Ice breakup, Foreign research, Channel enlargement, Bankful discharge.

Results from 24 rivers studied in Alberta showed that bankfull recurrence intervals average 16.7 yr, ranging between 2.4 and 45 yr. These results differ sharply from the average of 1.6 yr for rivers in warmer countries such as Great Britain, Australia, and the United States. The difference in frequency of return period for Alberta rivers may be attributed to channel enlargement caused by the occurrences of scour from ice breakup, drives, and jams of unknown frequencies. The enlarged channel areas (cross sections) at bankfull average 2.6 times larger, but due to comparison adjustments, may be 3 times larger than comparable rivers at bankfull in the United States, and are thus able to carry an average of 4.7 times more discharge, taking into account the increase in velocity. Research is particularly needed on the role of river ice jams and drives in shaping channel geometry. (Humphreys-ISWS)
W79-07756

A MONTE CARLO ANALYSIS OF THE HYDROLOGIC EFFECTS OF SPATIAL VARIABILITY OF INFILTRATION,
Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 2G.
W79-07760

CHOOSING AMONG ALTERNATIVE HYDROLOGIC REGRESSION MODELS,
Universidad Simon Bolivar, Caracas (Venezuela).
J. B. Valdes, G. J. Vicens, and I. Rodriguez-Iturbe.
Water Resources Research, Vol. 15, No. 2, p 347-358, April 1979. 7 fig, 12 tab, 13 ref. NSF GK-41643X.

Descriptors: *Streamflow, *Floods, *Model studies, *Regression analysis, Mathematical models, Flow, Probability, Statistics, Precipitation(Atmospheric), Rainfall, Snowfall, Drainage area, Forests, Soils, Annual flood, Hydrology, Bayesian theory.

Bayesian theory provides for the explicity accounting of both parameter and model uncertainties. It was used in this work to derive a procedure for discriminating among alternative hydrologic regression models. In particular, the procedure was used to discriminate among alternative exogenous variables in regression models. Controlled experiments with hydrologic models were designed to test the proposed procedure under different assumptions on model prior probabilities, length of sample, and model subset. These examples showed that besides its theoretical advantages, the use of the Bayesian procedure unambiguously selects the correct model in most of the applications. (Sims-ISWS)
W79-07763

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 290, Price codes: A04 in paper copy, A01 in microfiche. Report to the Congress December 20, 1977, 29 p.

Descriptors: *Pollution abatement, *Water pollution sources, *Water quality, *Water quality control, Pollutants, Political aspects, Water quality standards, Water pollution control, Pollutant identification, Planning, Drainage, Drainage effects.

'Nonpoint' sources of water pollution -- sediment, acid mine drainage pesticides, and other pollutants carried into streams by runoff from rainstorms -- currently produce more than half of the pollutants entering the nation's waterways. If not controlled, nonpoint pollution will prevent attainment of national water quality goals and will continue to grow in significance as 'point' sources of pollution, such as factories and municipal waste treatment plants, are brought under control. Because the source of discharge is diffuse, nonpoint pollution is difficult to collect and treat. The best way to control it is to prevent as much of it as possible from reaching the water through proper land management. The federal Environmental Protection Agency (EPA) should plan more solutions to nonpoint water pollution sources. Because funds for water pollution control are limited, better data is needed to set priorities and evaluate alternatives for controlling water pollution. The EPA agrees that greater nonpoint source control effort is needed at federal, state and local levels. The EPA believes that the present program structure is the best possible, considering the various program constraints. (Fortin-Florida)
W79-07889

EXCEEDANCE PROBABILITY - DEPTH RELATIONSHIPS OF FLOODS FOR MARYLAND STREAMS WEST OF CHESAPEAKE BAY,
Geological Survey, Towson, MD. Water Resources Div.
W. J. Herb.
Geological Survey open-file report 78-171, March 1978. 14 p, 4 fig, 2 tab, 4 ref.

Descriptors: *Flood frequency, *Peak discharge, *Flood forecasting, *Regression analysis, *Maryland, Streams, Flood profiles, Flood stages, Flood protection, *Flood-depth relationships.

Regression analysis of flood-depth frequency and drainage area data for 46 streams on Maryland's Western Shore produced equations and curves which may be used to estimate depths of floods with exceedance probabilities of 50, 20, 10, 2, and 1 percent. A procedure is outlined to allow the reader to convert the estimated flood depths to an elevation above the streambed. (Woodard-USGS)
W79-07941

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN DELAWARE,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-07942

2F. Groundwater

GEOTHERMAL ENVIRONMENTAL IMPACT ASSESSMENT: BASELINE DATA FOR FOUR GEOTHERMAL AREAS IN THE UNITED STATES,
Geonomics, Inc., Berkeley, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 609, Price codes: A22 in paper copy, A01 in microfiche. Interagency Energy-Environment Research and Development Report No. EPA-600/7-78-188, September 1978. 358 p, 99 fig, 23 tab, 27 ref, 5 append. 68-03-2468.

Descriptors: *Geothermal studies, *Geysers, *Water analysis, *Water chemistry, *Basic data collections, Climactic data, Geology, Hydrology, Seismology, Imperial Valley(California), The Geysers(California), Klamath Falls(Oregon), Rio Grande Rift Zone(New Mexico), Groundwater, Groundwater resources, Groundwater availability, Groundwater basins, Technology, Research and development, Assessment, Thermal water.

A compilation and technical assessment of the existing data on climate, geology, hydrology, water chemistry and seismicity is presented for Imperial Valley and The Geysers in California, Klamath Falls, Oregon, and the Rio Grande Rift Zone, New Mexico. The information is the first step, or baseline data assessment, towards developing an environmental monitoring methodology emphasizing groundwater degradation for geothermal areas. The Imperial Valley, a sediment-filled structural trough undergoing intensive crustal deformation, active faulting, very high seismicity, and significant subsidence, displays high regional heat flow and contains six known geothermal resource areas. A new comprehensive fault map of the valley has resulted from the extensive data compilation. Numerous faults and notable seismic activity occur in the mountainous region of The Geysers. Hydrology and water quality are discussed for mine drainage basins in this region. The geothermal waters occurring in the Klamath Basin appear to be associated with faults and are located in rubbly, fractured basalt aquifers. Four main aquifers are identified in this area which historically has displayed very low seismicity. The Rio Grande Rift Zone, containing seven areas of potential geothermal interest, is difficult to interpret because of complex folding in the mountains and discontinuous faulting throughout. The drainage basins contain much saline water, and the available volume of fresh water varies. (Davison-IPA)
W79-07504

EFFECT OF DRAIN DIAMETER, OPENINGS AND ENVELOPES ON WATER TABLE DRAWDOWN,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs, and Y. K. Tang.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 2, p 326-333, March-April 1979. 10 fig, 4 tab, 17 ref.

Descriptors: *Drains, *Drawdown, *Water table, *Mathematical models, *Groundwater movement, Equations, Unsaturated flow, Saturated flow, Drainage systems, Depth, Soil profiles, Hydraulic conductivity, Hydraulic properties, Water levels, Computer models, Richards equations, Parallel drains, Effective radius, Envelopes.

Numerical solutions to the Richards equation for saturated and unsaturated flow to parallel drains were used to determine the effects of drain tube diameter, openings, and envelopes on water table drawdown. Conventional drain tubes with a finite number of openings in the walls were represented as completely open tubes with an effective radius, r sub e. The effect of drain tube size and the use of envelopes on water table drawdown were determined for different soils, drain spacings, and profile depths. It was concluded that envelopes will allow an increase in drain spacing without reducing the design drawdown rate. However, the allowable spacing increase is smaller than previously reported in the literature. The midpoint drawdown rate was found to be relatively insensitive to changes of one or two sizes in the drain tube diameter. Finally, it was shown that the effect of drain tube diameter on drainage rates is dependent on drain spacing and profile depth as well as hydraulic properties of the soil. (Visocky-ISWS)
W79-07545

GROUNDWATER CONTOUR MAPPING IN VENICE BY STOCHASTIC INTERPOLATORS, 1. THEORY,
IBM Scientific Center, Venice (Italy).
G. Gambolati, and G. Volpi.
Water Resources Research, Vol. 15, No. 2, p 281-290, April 1979. 10 fig, 4 tab, 12 ref.

Descriptors: *Groundwater, *Aquifers, *Mapping, *Model studies, Mathematical models, Water levels, Land subsidence, Saline water intrusion, Piezometry, Theoretical analysis, Stochastic processes, Analytical techniques, Hydrology, *Venice(Italy), Kriging techniques.

An adaptation of the kriging technique was developed and used to map the hydraulic head field, z, of three major aquifers underlying the Venetian lagoon. Available records came from a fairly small number of observation wells unevenly scattered across the mainland, Venice, and the littoral. The event to be reconstructed was conceptually idealized as the sum of (1) a deterministic component, m, giving the main trend of z, and (2) a stochastic component, e, giving the natural dispersion of z around m with zero mean, constant variance, and high autocorrelation. Both m and e were dependent on the observation scale. A physically based expression for m was selected, including the consideration of additional information related to the general hydrogeological context. To reduce the complexity of the choice, some unknown coefficients, a sub k, were introduced in m and determined 'a priori' by a best fit technique, for instance, the least squares method. The relationship between m and a sub k was not necessarily linear. The dispersion e was then assessed by a linear optimal stochastic interpolator, i.e., by a linear combination of the observed values with the requirement that the variance of the interpolation error, E, be minimal. Validation of the interpretation models selected for each of the three Venetian aquifers showed that the present approach yields accurate results provided the trend is correctly assessed. (See also W79-07560) (Sims-ISWS)
W79-07559

GROUNDWATER CONTOUR MAPPING IN VENICE BY STOCHASTIC INTERPOLATORS, 2. RESULTS,
IBM Scientific Center, Venice (Italy).
G. Volpi, G. Gambolati, L. Carbognin, P. Gatto, and G. Mozzi.
Water Resources Research, Vol. 15, No. 2, p 291-297, April 1979. 10 fig, 1 tab, 5 ref.

Descriptors: *Groundwater, *Aquifers, *Mapping, *Model studies, Mathematical models, Water levels, Land subsidence, Saline water intrusion, Piezometry, Stochastic processes, Analytical techniques, Hydrology, *Venice(Italy), Kriging techniques.

Reliable and flexible tools are required to keep under control the subsurface flow field of the Venetian lagoon and the related land subsidence. One such tool was given by the stochastic interpolator developed in paper 1 and used to map the 1973 and 1977 piezometry of three major Venetian aquifers. A fairly small number of test holes unevenly scattered across the mainland, Venice, and the littorals provided the input data. The output was the reconstructed hydraulic head together with an assessment of its reliability. The 1973 results showed the existence of a pronounced cone of depression centered upon the industrial area of Porto Marghera, which turned out to be by far the major pumping site in the whole area. Local withdrawals produce a minor cone in Venice, but they do not account for the overall head decline recorded there. The 1977 contour maps showed a substantial recovery of the flow field in the upper 250 m of the groundwater basin, thus providing documentary evidence for the recently observed rebound of the land surface. Significant residual withdrawals still occur in the lowest unit (approximate 280 m) of the aquifer system. (See also W79-07559) (Sims-ISWS)
W79-07560

MAP OF ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, LOCATION OF WELLS, AND LINES OF EQUAL DEPTH TO WATER FOR SPRING, 1978,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07701

U.S. GEOLOGICAL SURVEY, DENVER, COLORADO, RADIOCARBON DATES II,
Geological Survey, Denver, CO. Water Resources Div.
L. J. Schroder, R. L. Emerson, and W. A. Beetem.
Radiocarbon, Vol 20, No 2, p 200-209, 1978. 2 tab, 4 ref.

Descriptors: *Radioactive dating, *Groundwater, *Carbon radioisotopes, *Alkalinity, Sampling, Water wells, *Carbon-14.

This list includes C-14 measurements made between 1969 and 1973 that represent natural water samples. Calculations of dates are made with the radiocarbon half-life of 5568 + or - 30 years; plus or minus numbers quoted are the standard errors for the counting of radioactive disintegrations. The C-13 values reported are based on Craig PDB limestone standard (Craig, 1957) and were determined by Teledyne Isotopes, Inc., Westwood Laboratories (R, 1968, v 11, p 53-105). The total alkalinity as bicarbonate values reported were determined using techniques described by Brown and others (1970). All dates reported in this list are from water samples collected by members of the U.S. Geological Survey. The measurement of C-14 ages was financed through the Nevada Operations Office, U.S. Energy Research and Development Agency, formerly U.S. Atomic Energy Commission. (Woodard-USGS)
W79-07707

DETERMINATION OF HYDROLOGIC PARAMETERS FOR GLACIAL TILLS IN CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Resources.
D. Huntley, and R. B. Black.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 578, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1979. 19 p, 4 tab, 6 fig, 12 ref. OWRT A-077-CONN(2), 14-34-0001-7014.

Descriptors: *Hydrologic properties, *Glacial soils, Hydrogeology, *Transmissivity, Computer model, *Waste disposal, Aquifer characteristics, *Glacial till, *Contaminant transport, *Waste movement, Sanitary landfills, *Anisotropic flow, *Permeameters, Slug tests, Stratified sediments,

Quinebaug River Basin, Shetucket River Basin, Connecticut.

Glacial tills located in the upland areas of the Shetucket and Quinebaug River basins, Connecticut, were evaluated for transmissivity and hydraulic conductivity by performing slug-injection tests on nine, small diameter drilled wells and slug-withdrawal tests on nineteen existing, dug wells. Test data, analyzed using the type-curve method of Cooper et. al. (1967) and Papadopulos et. al. (1973) yielded values of horizontal hydraulic conductivity that ranged from 1.0 to 355 gpd/ft2 (0.13 to 14.46 m/day). Laboratory-determined values of horizontal hydraulic conductivity were obtained using specially-constructed permeameters on relatively undisturbed samples of till. Although grain-size distributions for these samples show a wide range of values, this variability was not reflected in the hydraulic conductivities, which ranged from 13 to 80 gpd/ft2 (0.53 to 3.26 m/day). A computer-model simulation utilizing the permeability contrasts and anisotropic nature of the till indicated that large variations of contaminant transport existed in the hypothetical aquifers when an average horizontal hydraulic conductivity is assumed for the till rather than accounting for high-hydraulic conductivity layers that might exist. Computer-model simulations of waste movement through a till aquifer, such as those presented in this study, have widespread application relative to the design of sanitary landfills and other forms of waste disposal in till and stratified sediments. (de Lara-Conn)
W79-07715

VARIATIONS IN SPECIFIC YIELD IN THE OUTCROP OF THE CARRIZO SAND IN SOUTH TEXAS AS ESTIMATED BY SEISMIC REFRACTION,
Texas Dept. of Water Resources, Austin.
G. L. Duffin, and G. R. Elder.
Report 229, April 1979. 61 p, 9 fig, 3 tab, 13 ref.

Descriptors: *Sand aquifers, *Seismic studies, *On-site tests, *Texas, Aquifers, Seismic properties, Groundwater resources, Porous media, Groundwater, Seismic waves, Saturated soils, On-site data collections, Methodology, Instrumentation, Testing procedures, Porosity, Aquifer characteristics, Specific yield, Water table aquifers, Zone of saturation, Travel time, Sound waves, Carrizo Sand(TX), Unsaturated zone.

Seismic soundings were made at 84 sites, situated along 20 profiles, on the outcrop of the Carrizo Sand in south Texas. These soundings were made to estimate lateral variations in the aquifer's total porosity and specific yield where the aquifer is under water-table conditions. Compressional wave velocities in the upper unsaturated portion of the aquifer were determined by refraction soundings. Empirical relationships were used to estimate total porosity values from the compressional wave velocities. Estimated specific yields were derived from the estimated total porosities. The porosity values obtained by these empirical methods agree closely with laboratory porosity determinations from core samples taken from 7 of the 84 seismic sounding sites. All of the averaged values for specific yield fall within the range usually specified for unconfined aquifers (5 to 35%). Because of depth limitations of equipment used in the soundings, it is probable that the estimated average specific yields from profiles spanning or nearly spanning the outcrop are more nearly representative of the full thickness of the aquifer than are the specific yields from profiles that parallel the strike. The higher specific yield values are found east of the Frio River and range from 26 to 32%. West of the Frio River, specific yield values range from 16 to 24%. (Humphreys-ISWS)
W79-07750

AN ISOTOPIC STUDY OF GROUNDWATER SEEPAGE IN THE CENTRAL KENTUCKY KARST,
Scottish Research Reactor Centre, East Kilbride.
R. S. Harmon.
Water Resources Research, Vol. 15, No. 2, p 476-480, April 1979. 3 fig, 2 tab, 24 ref.

Descriptors: *Karst hydrology, *Isotope studies, *Seepage, *Kentucky, *Groundwater, On-site investigations, Aquifers, Analytical techniques, On-site tests, On-site data collections, Stable isotopes, Groundwater movement, Flow, Meteoric water, Vadose water caves, *Great Onyx Cave(KY), *Mammoth Cave National Park(KY).

Ratios of 180/160 were determined for meteoric precipitation and vadose seepage at Great Onyx Cave in Mammoth Cave National Park from March through July 1973. Results of this study indicated that (1) the delta 180/dT for precipitation at this site is 0.38 parts per thousand/deg C, (2) short-term fluctuations in the 180/160 ratio of seepage water in the vadose zone above the cave do not affect the oxygen isotopic composition of the speleothem calcite precipitated in the cave, and (3) the residence time of seepage water in the vadose zone is about 2 weeks. From spot sampling of base level springs in November 1972, the isotopic composition of the karst groundwater body is estimated to be about delta 180 = -5.6 parts per thousand and delta D = -40 parts per thousand. (Humphreys-ISWS)
W79-07757

UNSTEADY INTERZONAL FREE SURFACE FLOW IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2G.
W79-07768

JORDAN AQUIFER OF IOWA,
Geological Survey, Iowa City, IA.
P. J. Horick, and W. L. Steinhilber.
Miscellaneous Map Series 6, 1978. 20 ref, 3 maps.

Descriptors: *Aquifers, *Data collections, *Groundwater resources, *Iowa, Groundwater, Water quality, Maps, Geology, Water balance, Hardness(Water), Water properties, Chemical properties, Dissolved solids, Specific capacity, Water wells, Well data, Potentiometric level, Hydraulic properties, Artesian aquifers, *Jordan aquifer(Iowa).

The purpose of this atlas was (1) to define and describe the spatial relations and physical characteristics of the Jordan aquifer, (2) to present information on the occurrence availability, use, and chemical quality of water in the aquifer, and (3) to define and delineate changes in the potentiometric surface of the aquifer. The geohydrologic information was divided into 3 subject headings that were presented on separate atlas sheets--geology, hydrology, and chemical quality. The Jordan aquifer is the most productive water-yielding unit of the Cambrian-Ordovician aquifer system, and is one of the most dependable sources of water supply for large capacity wells in Iowa. The total thickness of the aquifer ranges from about 400 to 450 feet in east-central and southeastern Iowa to about 150 feet or less in western Iowa. The transmissivity of the aquifer is estimated to range from about 500 ft sq/day in the western part of the state to about 5,000 ft sq/day in the northeastern part. (Humphreys-ISWS)
W79-07769

THE CITRONELLE AQUIFERS IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-07940

SPRINGS OF FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.; and Florida Bureau of Geology, Tallahassee.
For primary bibliographic entry see Field 1A.
W79-07946

GROUND-WATER DATA FOR MICHIGAN, 1977,
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
Geological Survey open-file report 79-332, 1979. 75 p, 5 fig, 3 tab, 101 ref

Descriptors: *Groundwater resources, *Michigan, *Water levels, *Aquifers, *Water quality, Water wells, Water yield, Water utilization, Well data, Hydrogeology, Hydrographs, Water level fluctuations, Water analysis, Chemical analysis.

This report summarizes data on ground-water levels in 157 observation wells, and provides information on water quality, well locations, depths, altitudes, and aquifers that they tap. Tabulated data include extremes of water levels for 1977 and for the period of record. Also tabulated is the pumpage of most major ground-water users in the State and quality data on selected wells sampled during 1975-77. Levels were generally below average in many wells during the year; however, levels returned to near normal by years end. During the year, water levels reached record highs in only 3 wells and dropped to record lows in 31 wells. (Woodard-USGS)
W79-07947

RECORDS OF GROUND-WATER RECHARGE AND DISCHARGE FOR THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS, 1934-77,
Geological Survey, San Antonio, TX. Water Resources Div.
R. W. Maclay, and R. A. Rappmund.
Edwards Underground Water District Bulletin 37, February 1979. 21 p, 3 fig, 5 tab, 35 ref.

Descriptors: *Groundwater recharge, *Aquifers, *Water yield, *Water level fluctuations, Hydrogeology, Maps, Drainage area, Data collections, Sites, Precipitation(Atmospheric), Texas, *San Antonio area, *Edwards aquifer.

The average annual ground-water recharge to the Edwards aquifer in the San Antonio area, Texas, from 1934 through 1977 was about 589,200 acre-feet. A maximum annual recharge of 1,711,200 acre-feet occurred in 1958, and a minimum annual recharge of 43,700 acre-feet occurred in 1956. A maximum annual discharge of 960,900 acre-feet occurred in 1977, and a minimum annual discharge of 388,800 acre-feet occurred in 1955. The maximum annual discharge by wells was 406,800 acre-feet in 1971. In addition to the tables of data, the report contains two maps showing (1) the hydrologic features in the San Antonio area and (2) the drainage basins and data-collection sites. (Woodard-USGS)
W79-07949

NORTHERN GROUNDWATER AND ENGINEERING PROBLEMS RELATED TO GROUNDWATER FLOW,
Department of the Environment, Calgary (Alberta). Hydrology Research Div.
R. O. van Everdingen.
In: Hydrology Research Division, Annual Progress Reports and Short Research Notes, 1977-78. p 21-26, 1979. 2 fig, 7 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. HR 74-2.

Descriptors: *Groundwater, *Groundwater flow, *Instrumentation, *Hydrologic systems, *Engineering, Gages, Pressure measuring instruments, Hydrology, Hydrologic data, On-site investigations, Recharge, Permafrost, Cold regions, Franklin Mountains(Canada), Mahony Lake(Canada), Lac des Bois(Canada).

Progress is summarized for the year 1977 for groundwater flow engineering related problems. Laboratory work was completed at the University of Calgary in determining radioactive and stable isotopes in rain, snow, ground ice, groundwater recharge, spring water evaporites, and precipitates. The on-going study of the frost mounds near Fort Norman involved the use of time lapse photography. Battery operated pressure recorders were installed in the karst areas of Mahony Lake and Lac des Bois to further investigate the hydrologic sys-

ems of these areas. One of the recorders indicated significantly increased recharge rate during June nd July after a rainy period. The frost blister type rost mounds have been described in a field trip uide for the Central Yukon-Alaska field trip of ne Third International Conference on Permafrost. Davison-IPA)
W79-07956

IATHEMATICAL MODELLING OF A WELL IELD, CHATHAM, N. B.,
Department of the Environment, Ottawa (Ontar-o). Hydrology Research Div.
. Vandenberg.
n: Hydrology Research Division, Annual Prog-ess Reports and Short Notes 1977-78. p 90-109, 979. 13 fig, 1 tab, 4 ref. Environment Canada nland Waters Directorate, Ottawa, Report Series lo. 64. HRO 77-2.

Descriptors: *Mathematical models, *Computer nodels, *Aquifer characteristics, *Well data, Saline water intrusion, Pumping, oundaries(Surfaces), Drawdown, Aquifer man-gement, Hydrogeology, Groundwater movement, Groundwater resources, Chatham(New Brunswick anada).

A mathematical model being formulated will be sed to simulate the hydraulic head distribution of ne aquifer supplying water to Chatham, New runswick. Simulation of past, present, and future umping will indicate areas of excessive draw-own and areas subject to future salt water intru-on. The work to date includes the selection of the rea to be modeled, the design of the finite differ-nce grid, and the establishment of boundary con-itions. Representative values of aquifer character-tics have been selected, a stable nonpumping ydraulic-head distribution has been obtained for ne pumping simulations, the history of pumping rom the Chatham well field has been simulated, nd auxiliary routines for data display have been rogrammed. The results of each stage of develop-nent are described, auxiliary programs are exam-ned, and a finite element model of the area to mulate steady-state hydraulic head surfaces is dis-ussed. Using the steady-state concept and the nodel parameters as they are presently set up, it is ossible to generate hydraulic surfaces for other umping schedules or to make changes in the quifer parameters. (Davison-IPA)
W79-07961

G. Water In Soils

APILLARY PRESSURE-SATURATION RELA-IONSHIPS FOR A FOREST SOIL,
Bureau of Land Management, Prineville, OR.
. J. Lenhard, and G. L. Bloomsburg.
Transactions of the American Society of Agricul-ural Engineers, Vol. 22, No. 2, p 357-360, March-April 1979. 8 fig, 2 tab, 8 ref.

Descriptors: *Capillary action, *Saturation, Forest soils, Soil moisture, Soil water, Soils, Pres-ure, Compaction, Soil compaction, Permeability, oil water movement, Capillary water, Capillary onductivity, Forests.

The Brooks-Corey capillary pressure-saturation re-ationship was applied to a volcanic-ash influenced orest soil under various compaction treatments. The relationship was shown to be statistically valid or a range of capillary pressure heads from 60 to ,165 cm of water by a goodness-of-fit analysis. Sims-ISWS)
W79-07542

APPLICATION OF AN INFILTROMETER YSTEM FOR DESCRIBING INFILTRATION NTO SOILS,
cience and Education Administration, Boise, ID. Northwest Watershed Research Center.
D. L. Brakensiek, W. J. Rawls, and W. R. Hamon.
Transactions of the American Society of Agricul-ural Engineers, Vol. 22, No. 2, p 320-325, March-April 1979. 7 fig, 5 tab, 21 ref.

Descriptors: *Infiltrometers, *Infiltration, *Soil moisture, Mositure content, Equations, Data collections, On-site data collections, Theoretical analysis, Model studies, Rainfall-runoff relationships, Least squares method, Kinetics, Gr

Design and operation of an infiltrometer system were discussed. Analysis of the infiltrometer data was presented by estimation of the parameters in the Green and Ampt infiltration equation. The procedure for correcting the observed time scale for the initial period of surface nonsaturation was illustrated. The Green and Ampt equation satisfactorily simulates the observed infiltration rate curve. (Visocky-ISWS)
W79-07543

AIR AND WATER MOVEMENT IN POROUS MEDIA: COMPRESSIBILITY EFFECTS,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
J. -Y. Parlange, and D. E. Hill.
Soil Science, Vol. 127, No. 5, p 257-263, May 1979. 2 fig, 1 tab, 14 ref.

Descriptors: *Soil water movement, *Porous media, *Air, *Compressibility, Model studies, Mathematical models, Laboratory tests, Wetting, Soil water, Moisture content, Sands, Soils, Zone of aeration, Infiltration.

This study presented an analysis of air and water movement in a sand column. The analysis took air compressibility into account. The influence of air on water intake was assessed when water content was imposed at the soil surface. When air can move freely ahead of the wetting front, it was found that air compressibility is negligible, but that air movement increases water intake by a small percentage. When air must escape through the sand surface, air compressibility increases water intake by a small percentage, although the overall effect of air movement is to reduce water flow. The results of the theory were illustrated and confirmed from previous experimental observations. (Sims-ISWS)
W79-07544

EFFECT OF DRAIN DIAMETER, OPENINGS AND ENVELOPES ON WATER TABLE DRAWDOWN,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W79-07545

WIND PROFILE PARAMETERS AND TURBULENCE INTENSITY OVER SEVERAL ROUGHNESS ELEMENT GEOMETRIES,
Science and Education Administration, Manhattan, KS.
For primary bibliographic entry see Field 2D.
W79-07547

SIMULATION OF ARID RANGELAND WATERSHED HYDROLOGY WITH THE USDAHL-74 MODEL,
Science and Education Administration, Boise, ID. Northwest Watershed Center.
For primary bibliographic entry see Field 2A.
W79-07557

HYDROLOGIC EFFECTS OF BRUSH CONTROL ON TEXAS RANGELANDS,
Science and Education Administration, Temple, TX.
For primary bibliographic entry see Field 2A.
W79-07558

AN INTRODUCTION TO WISCONSIN WETLANDS - PLANTS, HYDROLOGY, AND SOILS,
Geological Survey, Madison, WI. Water Resources Div.
R. P. Novitzki.
Univ. of Wisconsin-Extension, 1815 University Ave. Madison, Wis. 53706. Wisconsin University-Extension, Geologic and Natural History Survey report, February 1979. 19 p, 15 fig.

Descriptors: *Wisconsin, *Wetlands, *Soil types, *Soil-water-plant relationships, *Hydrologic budget, Marshes, Bogs, Swamps, Flooding, Vegetation, Water quality, *Wetlands classification, Grassy wetlands, Brushy wetlands, Forested wetlands.

Wetlands in Wisconsin are classified by plant communities and characteristics typical of each type are described. Grassy wetlands include seasonally flooded basins, wet meadows, marshes, and sedge meadows. Brushy wetlands include willow swamps, alder swamps, and brushy bogs. Forested wetlands include flood-plain forests, hardwood swamps, cedar swamps, and forested bogs. (Woodard-USGS)
W79-07706

UNIVERSAL CONSTANTS FOR SCALING THE EXPONENTIAL SOIL WATER DIFFUSIVITY,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
W. Brutsaert.
Water Resources Research, Vol. 15, No. 2, p 481-483, April 1979. 11 ref.

Descriptors: *Soil water, *Diffusivity, *Equations, *Mathematical models, Model studies, Wetting, Infiltration, Soil water movement, Sorption, Physical properties, Permeability, Transmissivity, Soils, Soil science, Universal constants.

The exponential form of the soil water diffusivity can be scaled either with the wetting front parameter phi sub f = x sub f/t to the 1/2 power or with the sorptivity A sub o = F/t to the 1/2 power; these variables, which arise in the problem of sorption in a dry soil, are x sub f the distance to the wetting front, t the time, and F the infiltrated water volume. It was shown that the three constants used in this scaling are not independent and that only one constant is needed. (Sims-ISWS)
W79-07754

THE HYDROLOGICAL RESPONSE OF HEADWATER AND SIDESLOPE AREAS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W79-07755

AN ISOTOPIC STUDY OF GROUNDWATER SEEPAGE IN THE CENTRAL KENTUCKY KARST,
Scottish Research Reactor Centre, East Kilbride.
For primary bibliographic entry see Field 2F.
W79-07757

A MONTE CARLO ANALYSIS OF THE HYDROLOGIC EFFECTS OF SPATIAL VARIABILITY OF INFILTRATION,
Science and Education Administration, Fort Collins, CO.
R. E. Smith, and R. H. B. Hebbert.
Water Resources Research, Vol. 15, No. 2, p 419-429, April 1979. 14 fig, 2 tab, 15 ref.

Descriptors: *Infiltration, *Variability, *Model studies, Mathematical models, Spatial distribution, Distribution patterns, Watershds(Basins), Rainfall, Precipitation excess, Ponding, Runoff, Monte Carlo method, Mathematics, Stochastic processes, Hydrology.

Monte Carlo simulation was employed to analyze the effects of random distribution of soil infiltration properties on the hydrologic performance of catchment areas. Soil hydraulic parameters were distributed with log normal distribution as reported from previous field measurements. Although independent sampling units were assumed, a discussion was presented on the nature and effect of spatial dependence. The composite infiltration rate of an area was simply the average, at a particular moment, of the infiltration rate of all points within that area. Rigorous treatment of the topic is a forbidding problem in stochastic differential equations. Monte Carlo simulation was used here to

study the effects of random distribution of soil properties on distribution of ponding time, composite areal rate, and bias due to variability in space. More accurate treatment for watersheds must also consider interaction of various points on the surface by way of overland flow paths. A distributed watershed simulation model was used for this purpose to demonstrate hydrograph biad due to deterministic spatial variability, and from random variation, plus the relation of bias to rainfall rate. An analysis was also made of the partial area contribution in early parts of storm runoff caused solely by random variation in surface soil properties. (Sims-ISWS)
W79-07760

USE OF SPECIFIC CONDUCTANCE AND CONTACT TIME RELATIONS FOR SEPARATING FLOW COMPONENTS IN STORM RUNOFF,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2B.
W79-07764

UNSTEADY INTERZONAL FREE SURFACE FLOW IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
J. A. Liggett, and P. L-F. Liu.
Water Resources Research, Vol. 15, No. 2, p 240-246, April 1979. 9 fig, 4 ref, 1 append. NSF ENG77-01479.

Descriptors: *Free surfaces, *Porous media, *Unsteady flow, *Model studies, Mathematical models, Hydraulic models, Permeability, Dams, Embankments, Hydraulics, Drawdown, Flow, Mathematics, Analytical techniques.

The behavior of the free water surface at discontinuities in permeability for steady flow has been known for more than 40 years and has been used in numerical solutions and flow net sketching. The present paper extended that analysis to unsteady flow, primarily for use in numerical solutions. For a rising free surface, the diffraction between zones was given in graphical form. For a falling free surface, (almost) no diffraction solution existed, and the free surface was either horizontal or tangent to the line of discontinuity. However, sharp curvatures may occur in the vicinity of a permeability change, so care must be exercised in extrapolating free surface slopes to neighboring regions. (Sims-ISWS)
W79-07768

2H. Lakes

THE TRANSPORT AND RESUSPENSION OF SEDIMENTS IN A SHALLOW LAKE,
Aeronautical Research Associates of Princeton, Inc., NJ.
Y. P. Sheng, and W. Lick.
Journal of Geophysical Research, Vol. 84, No. C4, p 1809-1826, April 1979. 24 fig, 1 tab, 32 ref.

Descriptors: *Sediment transport, *Lakes, *Lake Erie, *Great Lakes, Suspended load, Suspended solids, Waves(Water), Hydraulics, Lake sediments, Flow, Equations, Mathematical studies, Model studies, *Sediment resuspension, Sediment models, Wave hindcasting model, Shallow lakes.

The time-dependent flow and dispersion of suspended sediments in the western basin of Lake Erie are being studied by means of numerical models utilizing data from remote-sensing studies and flume experiments. Mechanisms of sediment dispersion included in the models are convection and turbulent diffusion, river loading, gravitational settling, and physical resuspension and deposition at the sediment-water interface. The time-dependent currents were computed by means of a free surface hydrodynamic model. A wave-hindcasting model was used to compute the wave parameters needed for estimation of shear stress generated at the sediment-water interface under given wind conditions. The rate of sediment resuspension as a function of bottom shear stress and sediment properties was based on data from flume experiments using lake sediments. A series of numerical calculations with the models were performed on a two-dimensional lake with a variable bottom representing a transverse cross section of Lake Erie. It was found that wind direction and fetch length can significantly affect the sediment dispersion patterns. The two-dimensional and the three-dimensional models were both used to simulate realistic short-term events in Lake Erie, and the model outputs compared favorably with the synoptic surface sediment dispersion patterns deduced from the multispectral scanner data. (Lee-ISWS)
W79-07541

COLLIE RIVER UNDERFLOW INTO THE WELLINGTON RESERVOIR,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-07552

THE NATURAL RESOURCES OF AGUA HEDIONDA LAGOON. REPORT NUMBER 16 ON CALIFORNIA COASTAL WETLANDS,
San Diego Univ., CA. Environmental Studies Center.
J. Bradshaw, B. Browning, K. Smith, and J. Speth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 996, Price codes: A08 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, June, 1976. 110 p, 19 fig, 2 tab, 64 ref.

Descriptors: *Lagoons, *California, *Management, Wetlands, Natural resources, Land use, Dual purpose, Industry, Planning, Agua Hedionda Lagoon.

The greatest threat to the present status of the lagoon and its wetland habitats is the continuing pressure for development of the lagoon and its watershed. City zoning plans indicate the lagoon as open space and the periphery as residential, agricultural, and industrial. Use of the outer lagoon is more restricted; the primary use of this area is for a cooling water intake basin for a power plant. A descriptive inventory of the natural resources found on the lagoon is given as well as guidelines for the multiple-use, management, preservation, and enhancement of those resources. (Steiner-Mass)
W79-07731

NUTRIENT DYNAMICS OF FRESHWATER RIVERINE MARSHES AND THE ROLE OF EMERGENT MACROPHYTES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2K.
W79-07734

NUTRIENT RELATIONSHIPS IN THE DETRITUS OF A TROPICAL SWAMP,
Makerere Univ., Kampala (Uganda). Dept. of Botany.
For primary bibliographic entry see Field 2K.
W79-07736

FOREST SITES, BOG PROCESSES, AND PEATLAND TYPES IN THE GLACIAL LAKE AGASSIZ REGION, MINNESOTA,
Lake States Forest Experiment Station, St. Paul, MN.
M. L. Heinselman.
Ecological Monographs, Vol. 33, No. 4, p 327-373, Autumn 1963. 29 fig, 6 tab, 126 ref.

Descriptors: *Bogs, *Minnesota, Wetlands, Fens, Peat, Distribution patterns, Geomorphology, Classification, Forests, Ecological distribution.

The identity of the patterned bogs and fens of this region was established. Features that clearly mark the Lake Agassiz peatlands as members of the circumboreal group include string bogs (Strangmoor), topographically oriented forest islands, and fields of regularly spaced islands. The decisive influence of water movement patterns on floristics and forest sites was underscored. The key seems to be the degree of isolation from mineral-influenced groundwater. The course of such waters through bogs is often marked by water-track vegetation types. A tentative classification of peatland types is proposed. (Steiner-Mass)
W79-07739

BIOLOGICAL PRODUCTION AND NUTRIENT STUDIES OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Zoology.
For primary bibliographic entry see Field 2I.
W79-07741

EFFECTS OF SPRING WATER LEVELS ON THE REPRODUCTION OF UPPER RICHELIEU AND MISSISQUOI BAY: NORTHERN PIKE (ESOX LUCIUS L.),
Quebec Univ., Montreal (Canada), Dept. of Biology.
For primary bibliographic entry see Field 2I.
W79-07742

LAKE CHAMPLAIN FISHERIES INVESTIGATION: UNITED STATES WATERS,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 2I.
W79-07743

ANALYSIS OF ECONOMIC EFFECTS OF WATER SURFACE ELEVATIONS ON U.S. SHORELINE OF LAKE CHAMPLAIN, NEW YORK AND VERMONT,
URS/Madigan-Praeger, Inc., New York.
For primary bibliographic entry see Field 6B.
W79-07744

THE EFFECT OF LAKE DESTRATIFICATION ON WATER QUALITY,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. M. Steichen, J. E. Garton, and C. E. Rice.
Journal of the American Water Works Association, Vol. 71, No. 4, p 219-225, April 1979. 13 fig, 1 tab, 11 ref. OWRT A-028-OKLA (3), 14-31-0001-4036.

Descriptors: *Destratification, *Lakes, *Water quality, Hypolimnion, Temperature, Water temperature, Oxygen, Dissolved oxygen, Pumping, Equipment, Hydrogen ion concentration, Carbon dioxide, Alkalinity, Biochemical oxygen demand, Conductivity, Plankton, Diatoms, Algae, Biology.

The effectiveness of a modifies axial flow pump on thermal and dissolved oxygen stratification of a selected lake was measured according to physical-chemical and biological data. Mechanical variables--use of the pump with and without the diffuser, using diffusers of different materials, and varying the pitch of the propeller--were assessed to determine the optimum operating conditions for lake destratification. (Sims-ISWS)
W79-07745

BLACK WATER AND TWO PECULIAR TYPES OF STRATIFICATION IN AN ORGANICALLY LOADED STRIP-MINE LAKE,
Southern Illinois Univ. at Carbondale. Dept. of Zoology.
J. B. Stahl.
Water Research, Vol. 13, No. 5, p 467-471, 1979. 8 fig, 23 ref.

Descriptors: *Strip mine lakes, *Stratification, *Water quality, *Illinois, Surface waters, Lakes, Thermal stratification, Profiles, Iron, Alkalinity, On-site investigations, Sampling, On-site tests, Analysis, Dissolved oxygen, Hydrogen ion concentration, Water temperature, Data collections, *Jackson County(IL), Anoxic zone.

During summer stratification, a strip mine lake in which fish were cultured in floating cages developed black water in its anoxic zone. The blackness

evidently was produced by ferrous sulfide. Two types of black water stratification were observed. In one, the blackness occurred throughout the anoxic zone but was more intense in the upper part, while iron and alkalinity were high throughout this zone. In the second, the black water was confined to a meter-thick stratum within the anoxic zone, and iron and alkalinity were remarkably low except in two strata: the one with black water, and the one at the top of the anoxic zone. It was suggested that both types of stratification were caused by a high rate of sulfide production in the metalimnion. The relatively high temperature there (as compared to the hympolimnion) and the presumably higher concentrations of organic matter and ammonia, resulting from fish food and fish wastes, account for this high rate of sulfide production. Because of sharp oxygen stratification, 2 carbonate-forming processes, photosynthesis and sulfate reduction, occurred in close proximity to each other. In especially calm weather, vertical density currents of stratification. If the second type of stratification could be produced at will, it might be used to improve the quality of strip mine lake water. (Humphreys-ISWS)
W79-07747

NUTRIENT BUDGET ANALYSIS FOR REND LAKE IN ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality, Section.
For primary bibliographic entry see Field 5A.
W79-07748

SPATIAL VARIABILITY AND UNCERTAINTY IN GROUNDWATER FLOW PARAMETERS: A GEOSTATISTICAL APPROACH,
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Center for Geological Information.
J. P. Delhomme.
Water Resources Research, Vol. 15, No. 2, p 269-280, April 1979. 13 fig, 1 tab, 20 ref.

Descriptors: *Groundwater, *Transmissivity, *Model studies, Mathematical models, Groundwater movement, Distribution patterns, Spatial distribution, Variability, Aquifers, Infiltration, Statistics, Statistical models, Hydrogeology.

A geostatistical approach was proposed for characterizing the uncertainty about the transmissivity field of an aquifer and analyzing its effect on predicted head values. A new methodology was developed which couples conditional simulation and groundwater flow modeling. Conditional simulation was used for generating different two-dimensional transmissivity fields that all have the same spatial variability as the true field and are consistent with the measured T values at well locations. Two case studies were presented in order to illustrate the method, and conclusions were drawn for future investigation. (Sims-ISWS)
W79-07766

2I. Water In Plants

AN INTRODUCTION TO WISCONSIN WETLANDS - PLANTS, HYDROLOGY, AND SOILS,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 2G.
W79-07706

THE COASTLINE,
Saint Catharine's Coll., Cambridge (England). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W79-07718

EXISTING STATE AND LOCAL WETLAND SURVEYS (1965-1975). VOLUME II: NARRATIVE,
Martel Labs., Inc., Baltimore, MD.
For primary bibliographic entry see Field 7B.
W79-07726

TRACE AND TOXIC METAL UPTAKE BY MARSH PLANTS AS AFFECTED BY EH, PH, AND SALINITY,
Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
For primary bibliographic entry see Field 2K.
W79-07727

THE NATURAL RESOURCES OF THE NIPOMO DUNES AND WETLANDS. REPORT NUMBER 15 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07730

THE NATURAL RESOURCES OF MUGU LAGOON. REPORT NUMBER 17 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W79-07732

THE NATURAL RESOURCES OF ANAHEIM BAY--HUNTINGTON HARBOUR. REPORT NUMBER 18 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07733

NUTRIENT DYNAMICS OF FRESHWATER RIVERINE MARSHES AND THE ROLE OF EMERGENT MACROPHYTES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 2K.
W79-07734

NUTRIENT RELATIONSHIPS IN THE DETRITUS OF A TROPICAL SWAMP,
Makerere Univ., Kampala (Uganda). Dept. of Botany.
For primary bibliographic entry see Field 2K.
W79-07736

VEGETATION OF THE ATLANTIC COASTAL RIDGE OF PALM BEACH COUNTY, FLORIDA,
Florida Atlantic Univ., Boca Raton, Dept. of Biological Sciences.
D. R. Richardson.
Florida Scientist, Vol. 40, No. 4, p 281-330, Fall 1977. 7 fig, 1 tab, 68 ref.

Descriptors: *Coastal plains, *Vegetation, *Distribution patterns, Wetlands, Florida, Drainage, Drainage effects, Succession.

Predrainage vegetational patterns were mapped for the Atlantic Coastal Ridge of Palm Beach County. A detailed analysis of vegetational changes regarding secondary succession was made by selecting specific areas throughout the overall study region. These areas were described by documenting community changes with regard to species composition and community location. A checklist of the vascular flora was made for each selected area. Using the entire coastal strip vegetation maps and specific study sites, generalizations were made regarding plant succession in the major plant communities: Beach, Coastal Strand, Tropical Hammock, Low Hammock, Scrub, Pine latwoods, Wet and Dry Prairies, Mangroves, Swamps, and Freshwater Marshes. Pre-and post-drainage historical and hydrological information was correlated with geological history in order to show how the physical and biological factors affect vegetation. (Steiner-Mass)
W79-07737

FOREST SITES, BOG PROCESSES, AND PEATLAND TYPES IN THE GLACIAL LAKE AGASSIZ REGION, MINNESOTA,
Lake States Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 2H.
W79-07739

BIOLOGICAL PRODUCTION AND NUTRIENT STUDIES OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Zoology.
E. B. Henson, and M. Potash.
Prepared for the International Joint Commission, International Champlain-Richelieu Board, August 1977. 58 p, 6 fig, 17 tab, 38 ref.

Descriptors: *Lake Champlain, *Water levels, *Marsh plants, *Marsh management, Water level fluctuations, Wetlands, Marshes, Freshwater marshes, Nutrients, Nitrogen, Aquatic animals, Reservoir management, Zooplankton, Aquatic plants.

An evaluation was made of the ecological significance of the distribution and abundance of higher plants, algae, zooplankton, and large invertebrates and of the dynamics of the basic nutrients entering, being cycled, and leaving a Lake Champlain wetland. For best growing conditions, water levels should be maintained at about 98.4 feet from late May through June and should not go below 97.4 feet. From July through the remainder of the growing season, the water level should not be reduced below 95.8 feet with 95.1 feet as an absolute minimum. This level permits lateral movement of water through the emergent zone, thus providing needed nutrients, and also maintains an ample submergent-floating zone within the wetland. It is the submergent zone which supports the greatest densities of macroinvertebrates, used for food by fish. Lake levels maintained below 95.1 feet during the winter will serve to kill off much of the aquatic vegetation and cause increased decomposition in the spring and summer, and releasing a greater amount of nutrients into the lake. (Steiner-Mass)
W79-07741

EFFECTS OF SPRING WATER LEVELS ON THE REPRODUCTION OF UPPER RICHELIEU AND MISSISQUOI BAY: NORTHERN PIKE (ESOX LUCIUS L.),
Quebec Univ., Montreal (Canada), Dept. of Biology.
P. Dumont, and R. Fortin.
Prepared for International Joint Commission, International Champlain-Richelieu Board, August 1977. 105 p, 18 fig, 18 tab, 29 ref.

Descriptors: Lake Champlain, *Water levels, *Pikes, *Spawning, Water level fluctuations, Fish management, Lakes, Fish, Fish reproduction, Aquatic habitats, Reservoir management.

Upper Richelieu and Missisquoi Bay floodplain and wetland areas were classified in terms of northern pike spawning and early development potential. All four potential spawning areas begin to be inundated at lake level 98.5 feet and are productive at 100 feet. Good fry production also seems to be related to relatively stable water level conditions for 30-40 days after the lake reaches 98.5 feet and to a gradual drawdown from the peak. If regulation is decided upon, a predictive model based upon air temperature profiles, precipitation, etc., should be elaborated from the historical data available for Lake Champlain. Also, measures should be taken in order to protect all high potential spawning areas from drainage and land fill for development. (Steiner-Mass)
W79-07742

LAKE CHAMPLAIN FISHERIES INVESTIGATION: UNITED STATES WATERS,
New York State Dept. of Environmental Conservation, Albany.
Prepared for the International Joint Commission, International Champlain-Richelieu Board, August 1977 229 p, 11 fig, 5 tab, 211 ref, 7 append.

Descriptors: *Fish reproduction, *Water levels, *Freshwater marshes, *Pike, *Lake Champlain, Wetlands, Spawning, Marshes, Fish management, Lakes, Fish, Reservoir management, Aquatic habitat.

Healthy northern pike populations exist throughout the Lake Champlain wetlands but tend to be more dominant in the low gradient wetlands located near the northern portions of the lake. Flooded terrestrial vegetation such as grasses and grass-brush-tree combinations and aquatic emergents appeared as the preferred substrate for spawning. Water levels above 30.0 during the spawning period were the minimum levels required for access to and flooding of vegetative types necessary for egg deposition. If lake level regulation is implemented, inundation of this habitat for a duration of 40-50 days at least once every three years would potentially insure egg and fry survival. Dropping of water levels to avoid flooding during the critical egg and spawning period would have an adverse affect on northern pike production. Reduction of lake elevations from 31.0 to 29.5 m would eliminate approximately 42% of the 37,500 mapped wetlands now existing. (Steiner-Mass)
W79-07743

IRRIGATED CORN YIELD RESPONSE TO WATER,
Southwestern Great Plains Research Center, Bushland, TX.
J. T. Musick, and D. A. Dusek.
Paper No. 78-2557, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 26 p, 8 fig, 3 tab, 16 ref. ASAE, St, Joseph, Michigan.

Descriptors: *Irrigation efficiency, Crop response, Moisture deficit, Evapotranspiration, Moisture stress, *Corn, Water requirements, Yield equations, Growth stages.

Corn grain yield response to water deficits and seasonal evapotranspiration-yield relationships were determined during a 3-yr study in the Southern High Plains. Sensitivity of yields and water-use efficiencies to plant-water stress indicated that limited irrigation should not be practiced in the high-evaporative demand climate. (Skogerboe-Colorado State).
W79-07793

EVALUATION OF CROP WATER STRESS UNDER LIMITED IRRIGATION,
Science and Education Administration, Fort Collins, CO. Agricultural Research.
D. Heermann, and H. Duke.
Paper No. 78-2556, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 5 p, 8 fig, 8 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Moisture stress, Moisture deficit, *Sprinkler irrigation, Soil moisture, Yield equations, Corn, Growth stages.

Limited water application plots were established under 2 center pivot systems planted to corn. Stress was quantified by measuring water applied, soil water, canopy temperatures and plant water potentials. Yield reductions were linearly related to applied water and average canopy temperature differences between control and stressed plots. (Skogerboe-Colorado State)
W79-07892

2J. Erosion and Sedimentation

IDENTIFICATION OF SUSPENDED SEDIMENT SOURCES BY MEANS OF MAGNETIC MEASUREMENTS: SOME PRELIMINARY RESULTS,
Liverpool Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W79-07533

MODEL FOR SUSPENDED SEDIMENT TRANSPORT,
Waterloopkundig Lab., Delft (Netherlands).
P. M. J. Kerssens, A. Prins, and L. C. van Rijn.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, p 461-476, Proceedings Paper 14574, May 1979. 12 fig, 14 ref, 2 append.

Descriptors: *Mathematical models, *Diffusion, *Sedimentation, Sediment transport, Estuaries, Suspended load, Dredging, Diffusion, Hydraulics, Model studies, Rivers, Equations, River morphology, River geometry, Diffusion-convection equation, Sediment diffusion.

A mathematical model for suspended sediment transport was described. The model enables the investigation of certain effects of river works or geometrical changes, or both, in a river or estuary by morphological computations. The model is based on the two-dimensional diffusion-convection equation. This equation describes the distribution of the sediment concentrations in a two-dimensional flow field by diffusion and convection. For the local velocities in the vertical, the logarithmic distribution was used, while for the sediment diffusion coefficient a new expression was applied. The diffusion-convection equation was solved by an implicit numerical method using a coordinate transformation, while the influence of the diffusion coefficient on the adaptation of the transport in the case of an overcapacity of sediment was presented. A dimensionless graph of the adaptation length of a uniform concentration vertical was given. The application of the model for tidal flow was described, and for such conditions a prototype verification and a sensitivity analysis were given. The model is limited to situations with relatively small changes in lateral direction and nongraded bed. (Lee-ISWS)
W79-07537

COMPARTMENTED SEDIMENT TRAP,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
P. J. Murphy, and M. I. Amin.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14577, p 489-500, May 1979. 9 fig, 1 tab, 9 ref, 2 append.

Descriptors: *Bed load, *Sediments, *Sediment transport, Trap efficiency, Instrumentation, Streambeds, Measurements, Hydraulics, Equipment, Rivers, Streams, On-site investigations, Mathematical studies, Particle size, Compartmented sediment trap.

A method for measuring sediment transport was presented. The measurement device is a portable, compartmented, bottom trap that is operated by burying the trap in the stream bed, waiting until the natural bedforms are reestablished, and then opening the trap during a time interval sufficient to collect a large number of moving particles. The sections of the trap allow the calculation of the fractions of the sediment that jump various lengths as they move along the bed. The jump-length distribution permits the direct calculation of the efficiency of the trap for the various grain sizes of the moving sediment. The compartmented trap was field tested in a sand-bottomed creek
W79-07538

DISCRETE DYNAMIC MODEL OF WATERSHED SEDIMENT YIELD,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
T. C. Sharma, and W. T. Dickinson.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14592, p 555-571, May 1979. 6 fig, 10 tab, 11 ref, 1 append.

Descriptors: *Sediment yield, *Watersheds(Basins), *Model studies, *Mathematical models, Rainfall, Runoff, Suspended solids, Sediments, Bed load, Regression analysis, Statistics, Statistical models, Erosion, Soil erosion, Pollutants, Path of pollutants, Streams, Streamflow, Sedimentation.

The watershed fluvial system was hypothesized as a lumped system with runoff rate (log-transformed) as input and sediment yield rate (log-transformed) as output on a discrete time basis. The effects of errors in sampling, data reduction, discretizing, etc., of input and output sequences were simulated by another linear system to which input is a white noise. A first-order dynamic model with 5 parameters was demonstrated to provide an adequate model of monthly runoff-sediment yield process. A second-order dynamic model with 7 parameters adequately models the daily runoff sediment yield process. The noise component was found to be a white noise sequence in both cases, explaining 10% to 19% of the variance in the monthly sediment yields and 3% to 5% of the variance in the daily sediment yields. A linear linkage model explains 81% to 90% of the variance in the monthly sediment yields and 95% to 97% of the variance in daily sediment yields. (Sims-ISWS)
W79-07539

THE TRANSPORT AND RESUSPENSION OF SEDIMENTS IN A SHALLOW LAKE,
Aeronautical Research Associates of Princeton, Inc., NJ.
For primary bibliographic entry see Field 2H.
W79-07541

SEDIMENT LOADS IN THE AMAZON RIVER,
Geological Survey, Denver, CO. Water Resources Div.
R. H. Meade, C. F. Nordin, Jr., W. F. Curtis, F. M. Costa Rodriques, and C. M. do Vale.
Nature, Vol. 278, p 161-163, 8 March 1979. 3 fig, 1 tab, 9 ref.

Descriptors: *Sediment transport, *Sediment yield, *Suspended load, *Rivers, *Fluvial sediments, Peru, Brazil, *Amazon River, Rio Negro, Rio Madeira.

In late May and early June 1977, suspended-sediment transport rates in the Amazon mainstem ranged from 1.4 to 1.7 x 10 to the 6th power metric tons per day in lower Peru and upper Brazil to 4.7 x 10 to the 6th power metric tons per day at Obidos in lower Brazil. Combining these data with data collected earlier allows us to calculate a new estimate of 8 to 9 x 10 to the 8th power metric tons for the mean annual suspended-sediment discharge at Obidos. (Woodard-USGS)
W79-07710

THE COASTLINE,
Saint Catharine's Coll., Cambridge (England). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W79-07718

MUDDY FORESHORES,
Nature Conservancy Council, Hampshire (England).
For primary bibliographic entry see Field 2L.
W79-07720

EFFECTS OF CHANNEL ENLARGEMENT BY RIVER ICE PROCESSES ON BANKFULL DISCHARGE IN ALBERTA, CANADA,
Calgary Univ. (Alberta). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W79-07756

USE OF SPECIFIC CONDUCTANCE AND CONTACT TIME RELATIONS FOR SEPARATING FLOW COMPONENTS IN STORM RUNOFF,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 2B.
W79-07764

SEDIMENT TRAPS IN CHANNELS--DESIGN PROCEDURES AND PERFORMANCE,
Soil Conservation Service, East Lansing, MI.
G. R. Konwinski.
Paper No. 78-2561, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 6 p. 2 fig. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment control, Stream erosion, *Channel erosion, Stream stabilization, Trap efficiency, Bed load, Energy dissipation, Channel flow, Design data.

The design and maintenance of sediment traps to control a stream's energy play a key role in ensuring uniform cross-sectional area in trapezoidal channels. It was suggested that the bedload and the upland must be carefully analyzed to determine the critical energy level which is the first step in the design of a successful in-channel sediment trap. The procedure provided design data needed to proportion the sediment trap to trap bedload sediments by reducing flow velocity through the trap. (Skogerboe-Colorado State)
W79-07804

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

SEDIMENT TRANSPORT BY IRRIGATION RETURN FLOWS, ON THE YAKIMA INDIAN RESERVATION, WASHINGTON 1975 AND 1976 IRRIGATION SEASONS,
Geological Survey, Tacoma, WA. Water Resources Div.
L. M. Nelson.
Geological Survey open-file report 78-947, 1979. 42 p, 5 fig, 4 tab, 9 ref.

Descriptors: *Sediment transport, *Irrigation water, *Runoff, *Sediment yield, *Discharge(Water), Data collections, Turbidity, Temperature, *Yakim Indian Reservation(Wash).

As determined from data collected at 10 sites on the Yakima Indian Reservation, Wash., during the 1975 and 1976 irrigation seasons (April-September), seasonal sediment discharges in irrigation return flows ranged from 11,000 tons from Marion Drain and Satus Drain 302 to 400 tons from Coulee Drain. There was little variation between the sediment discharges of the 1975 and 1976 irrigation seasons except those from Satus Drain 302. Due to the lack of natural runoff during those seasons, no distinction could be made between sediment discharges from irrigated and nonirrigated areas. No significant or usable relationships were found between suspend-sediment concentration and concurrent water turbidity or discharges. (Woodard-USGS)
W79-07953

2K. Chemical Processes

CHEMICAL CHARACTERISTICS OF SMALL STREAMS NEAR HANEY IN SOUTHWESTERN BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Faculty of Forestry.
M. C. Feller, and J. P. Kimmins.
Water Resources Research, Vol. 15, No. 2, p 247-258, April 1979. 4 fig, 6 tab, 64 ref.

Descriptors: *Water chemistry, *Forest watersheds, *Water quality, *Canada, Forests, Streams, Streamflow, Chemicals, Nutrients, Sampling, Chemical analysis, Storm runoff, Temperature, Water temperature, Sediments, Suspended solids, Evapotranspiration, Water balance, Chemistry, *British Columbia.

The hydrological, thermal, and chemical characteristics of two small streams flowing through relatively undisturbed, low-elevation mountain watersheds in southwestern British Columbia were investigated. All observations and chemical analyses of ecosystems were consistent with the hypothesis that stormflow originated mainly from flow of water through soil macrochannels to groundwater and thence to streams. Water budgets indicated unmeasured groundwater losses. The streams exhibited annual chemical cycles for most parameters, with maximum values in late summer and early autumn and minimum values in winter and early spring. Nitrate concentrations displayed no consistent seasonal variation, whereas potassium and sulphate concentrations were relatively uniform throughout the year. Most chemical parameters decreased with increasing discharge, whereas dissolved oxygen concentrations increased. Potassium concentrations exhibited some increases and some decreases, and chloride, nitrate, and sulphate concentrations were generally not significantly related to discharge. Concentration-discharge relationships were used to infer the origin of stormflow water. Differences in the chemistry of the two very similar streams have important ramifications for the design of watershed nutrient studies. Nutrient budgets were very similar to those of other watersheds in humid temperate regions, with net losses of calcium, sodium, magnesium, potassium, chloride, and sulphur. Nitrogen and phosphorus exports in dissolved or particulate organic form were not measured. Based on dissolved inorganic measurements, nitrogen was accumulated, while any gains or losses of phosphorus were extremely small. (Sims-ISWS)
W79-07540

ARSENIC IN STREAMS, STREAM SEDIMENTS, AND GROUND WATER, FAIRBANKS AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W79-07563

TEMPERATURE AND PH AS LIMITING FACTORS IN LOSS OF NITRATE FROM SATURATED ATLANTIC COASTAL PLAIN SOILS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
J. W. Gilliam, and R. P. Gambrell.
Journal of Environmental Quality, Vol. 7, No. 4, p 526-532, October-December, 1978. 5 fig, 2 tab, 35 ref. OWRT A-083-NC (4), 14-34-0001-7070.

Descriptors: *Nitrates, Reduction(Chemical), *Denitrification, Nitrogen, Groundwater, Atlantic Coastal Plain.

Nitrate reduction rates under water-saturated conditions were determined for two acid Atlantic Coastal Plain topsoils and their acid subsoils at 5, 15, and 25C. Nitrate reduction readily occurred in subsoils even at pH values of 4.5 when an energy source was added. It was concluded that the acid pH values which commonly occur in Atlantic Coastal Plain soils are not a serious limiting factor in NO3(-) reduction. It was also concluded that the temperatures of 5 to 15C which exist in the shallow groundwater of the Atlantic Coastal Plain soils during much of the winter limits the rate of NO3(-) reduction and nitrate reduction can occur in these soils at 5C but the rate is relatively slow and is highly dependent upon the amount of available C. A significant amount of NO3(-) reduction was expected during the winter in poorly drained soils which contain relatively high organic matter contents. (Skogerboe-Colorado State)
W79-07564

TRACE AND TOXIC METAL UPTAKE BY MARSH PLANTS AS AFFECTED BY EH, PH, AND SALINITY,
Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
D. W. Patrick, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 914, Price codes: A07 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi Technical Report D-77-40, December 1977. 124 p, 58 tab, 75 ref.

Descriptors: *Marsh plants, *Metals, *Plant growth substances, Grasses, Salinity, Hydrogen ion concentration, Copper, Lead, Plant growth, Toxins, Biochemistry, Trace elements.

Reasonably successful methods were developed for growing salt marsh plants under conditions of controlled pH, redox potential, and salinity to determine the effects of these physiochemical conditions in the rooting medium on trace and toxic metal availability to plants. Plant cadmium content responded more to change in the physiochemical environment of the rooting medium than did other metals studied. The cadmium content of aboveground was consistently and substantially increased with an increase in oxidation conditions in all species. Maximum cadmium content occurred under acid, oxidizing conditions except for one species in which an oxidized, weakly alkaline environment was favorable. An increase in soil oxidation-reduction conditions increased plant lead content, but this was attributed to a redox potential mediated effect on soil pH. Zinc content was found to increase with increasing oxidation conditions. There was little effect of either pH or oxidation-reduction conditions on the copper content of the species studied. (Steiner-Mass)
W79-07727

NUTRIENT DYNAMICS OF FRESHWATER RIVERINE MARSHES AND THE ROLE OF EMERGENT MACROPHYTES,
Oak Ridge National Lab., TN.
J. M. Klopatek.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF 770248-1, Price codes: A03 in paper copy, A01 in microfiche. 1977. 30 p, 9 fig, 5 tab, 78 ref.

Descriptors: *Freshwater marsh, *Cycling nutrients, *Rooted aquatic plants, *Marsh plants, Wisconsin, Wetlands, Aquatic environment, Soil-water-plant relationships, Aquatic plants, Drawdown, Nutrients, Phosphorus, Potassium, Nitrogen, Calcium, Magnesium, Bullrushes, Cattails, Willow trees.

Inundated and anaerobic soils of a freshwater riverine marsh show significant seasonal variations in available P and K and exchangeable Ca and Mg. Based primarily on investigations in Wisconsin, the role of emergent macrophytes within the marsh nutrient cycle is described. Concentrations of N, P, K, Ca, and Mg follow predictable trends over the growing season. However, the accumulation of these elements in the below and aboveground structures is shown to yield a more complete picture of the functional role of emergent macrophytes. Regression analyses showed nutrient uptake by the macrophytes was significantly correlated to total soil N and available P. Significant correlations were not shown for the other elements and is explained based upon their mobility and the possibility of luxury uptake. Models of the flow of nutrients in a Scirpus fluviatilis stand are depicted. The effects of a marsh drawdown on the nutrient cycle are also discussed as well as the nutrient dynamics of Salix interior, a typical riverine community shrub. (Bollinger-Mass)
W79-07734

NUTRIENT RELATIONSHIPS IN THE DETRITUS OF A TROPICAL SWAMP,
Makerere Univ., Kampala (Uganda). Dept. of Botany.
J. J. Gaudet.
Archives Hydrobiologia, Vol. 78, No. 2, p 213-239, August 1976. 8 fig, 13 tab, 32 ref, 1 append.

Descriptors: *Swamp, *Detritus, *Cycling nutrients, Africa, Tropic, Wetlands, Sedimentation, Leaching, Streamflow, Waste assimilation capacity, Water analyses, Water chemistry, Nutrients, Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Iron, Manganese, Chloride, Fluoride, Sulphur.

The various components in a papyrus swamp (Cyperus papyrus L.) are defined and illustrated using a swamp in Uganda as an example. The components including inputs and outputs were analyzed for N, P, K, Na, Ca, Mg, Fe, Mn, S, Cl, and F. Mineral elements can be: (1) immobilized by incorporation into plant material, (2) returned to the mat water by rain leaching, elution or decomposition, (3) or exported in the particulate material which becomes peat and sludge. However, all nutrients entering the swamp are eventually trapped in the bottom as sludge. Thus, papyrus swamps might be

better visualized as large holding tanks or septic tanks (rather than filters) in which a large amount of autochthonous organic matter is produced and settled out. The fate of nutrients in the detritus components thus make these components most important in nutrient cycling in these African swamps. (Bollinger-Mass)
W79-07736

MAP SHOWING GENERAL QUALITY OF GROUND WATER IN THE KAIPAROWITS COAL-BASIN AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Available from Branch of Distribution, USGS Box 25286, Fed. Ctr. Denver CO 80225 price $1.50. Geological Survey Miscellaneous Investigations Series Map I-1033-A, 1977. 1 sheet.

Descriptors: *Water quality, *Maps, *Groundwater, *Water wells, *Springs, Aquifers, Salinity, Utah, *Kaiparowits coal-basin area.

This is one of a series of maps that describe the geology and related natural resources in the Kaiparowits coal-basin area. Chemical analyses of water from about 40 widely scattered springs, 20 coal-exploration holes on the Kaiparowits Plateau, and 7 water wells in the vicinity of the communities of Escalante and Glen Canyon were used to compile this map. All the water samples were from depths of less than 1,000 feet. Water-quality data were also available from a number of petroleum wells and exploration holes more than 5,000 feet deep. Ground water in most parts of the Kaiparowits coal-basin area ranges from fresh to slightly saline. In general, the fresh waters are of the calcium bicarbonate type, and the saline water are of the sodium sulfate type. The available chemical analyses indicate that the ground water is generally freshest throughout the headwater areas of the Escalante River, along Cottonwood and Hackberry Canyons, and in the immediate vicinity of Lake Powell. In these areas, the springs sampled commonly contained less than 500 mg/L of dissolved solids. The ground water is generally most highly saline along the southern margin of the Kaiparowits Plateau and in the northeast corner of the study area. (Woodard-USGS)
W79-07937

GROUND-WATER DATA FOR MICHIGAN, 1977,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-07947

2L. Estuaries

TWO-DIMENSIONAL FLOW FIELD OF MULTIPORT DIFFUSER,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-07535

MODEL FOR SUSPENDED SEDIMENT TRANSPORT,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 2J.
W79-07537

THE COASTLINE,
John Wiley and Sons, New York, R. S. K. Barnes (Ed.), 1977. 356 p, 99 fig, 27 tab, 721 ref.

Descriptors: *Coasts, *Wetlands, *Shores, *Land management, Salt marshes, Estuaries, Coastal marshes, Coastal plains, Marsh management, Shore protection, Drainage.

This book has been divided into a series of sections, each covering one fairly uniform group of habitats--sandy foreshores, rocky cliffs, salt marshes, estuaries, etc. The common structural plan of the chapters is: first, a summary of the fundamental ecological and geomorphological processes operating in the environment in question; second, the special features of the environment in terms of ecology and characteristic pressures; third, methods of study; fourth, educational, scientific, recreational, or economic uses of the environment; and fifth, recommended conservation and management policies, including international case studies of success or failure studies. General introductory and concluding chapters are included to place the individual habitats in a wider perspective. (See W79-07718 thru W79-07722) (Steiner-Mass)
W79-07717

THE COASTLINE,
Saint Catharine's Coll., Cambridge (England). Dept. of Zoology.
R. S. K. Barnes.
In the Coastline, p 3-27, 1977. Barnes, R. S. K. (ed.). John Wiley and Sons, New York.

Descriptors: *Coasts, *Salt marshes, *Accretion, Wetlands, Coastal marshes, Coastal plains, Marsh management, Shores, Shore protection, Land management, Erosion.

The position of a coastline can be considered as the result of the operation of three independent factors: continental drift, relative land-sea level, and the local characteristics of the rate of erosion or accretion resulting from subaerial, fluviatile, or marine processes. Taking a coastline as a whole, erosion is occurring along a much greater length than is accretion. Accretion mainly occurs in the comparatively quiet waters of estuaries, semi-enclosed bays, and natural harbors. The effect of organisms in promoting accretion is large. Without salt-marsh plants, there would be little natural land reclamation and without dune grasses there would be few dune coastal sand dunes protecting the hinterland from tidal inundation. Change in the vertical height of a marsh surface (brought about by accretion) will affect the frequency of tidal cover and therefore the accretion rate. As a marsh increases in height, the accretion rate will first accelerate as the plant cover becomes more complete and comparatively bushy species succeed smaller ones, but it will decrease when tidal cover becomes infrequent. The other major activity determining the shape and position of the land-water boundary is the behavior of man, particularly in his roles as a reclaimer of land and a protector of coastlines. (See also W79-07717) (Steiner-Mass)
W79-07718

LAGOONS,
Ferrara Univ. (Italy). Inst. of Zoology and General Biology.
G. Colombo.
In the Coastline, p 63-81, 1977. Barnes, R. S. K. (ed.). John Wiley and Sons, New York.

Descriptors: *Lagoons, *Preservation, *Lake morphometry, Bays, Wetlands, Development, Conservation, Distribution, Land use, Land reclamation.

Lagoons are shallow bodies of brackish or sea water partially separated from an adjacent coastal sea by barriers of sand or shingle, which only leave narrow openings through which sea water can flow. In general, lagoons are associated with coastlines which have experienced or are experiencing change in the relative land-sea level. A lagoon will evolve either towards total isolation behind a complete sediment barrier, and thence from a coastal pond to swamp and marsh, or into a coastal bay again after erosion of the barrier. Besides the natural evolutionary trends, human activities often affect the structure of lagoons, primarily by hydraulic works, but also by land-reclamation schemes and through changes in the inland watershed. A lagoon is a comparatively simple system and has less homeostatic controls than most other systems; it is therefore comparatively easy to disturb, although it is not too difficult to preserve it in a moderately good condition. In many cases, ecological and hydrological investigation of a lagoon before specific projects are initiated will allow estimates to be made of the likely future evolution of the system and of its susceptibility to deteriorative changes. (See also W79-07717) (Steiner-Mass)
W79-07719

MUDDY FORESHORES,
Nature Conservancy Council, Hampshire (England).
C. R. Tubbs.
In the Coastline, p 83-92, 1977. Barnes, R. S. K. (ed.). John Wiley and Sons, New York.

Descriptors: *Mud flats, *Marsh management, *Shores, Coasts, Wetlands, Preservation, Conservation, Shore protection, Land management, Sediments, Mud, Mud-water interfaces, Tidal effects.

Mud flats are formed by the deposition of fine inorganic material and organic debris in particulate form, which has been held in suspension in the sea or in estuaries. Deposition tends to occur where the turbulence of the sea is most abated and the gradient of the underlying land is slight. In sheltered situations the deposits accumulate to form extensive, level or gently sloping expanses drained by networks of deeply incised channels, some formed by the flood tide and some by the ebb. The process of accretion over level expanses of mud leads naturally to the development of salt marshes, notably where the silt content is high and there is minimal tidal scour. The rapid spread of Spartina marsh since the 1870's has involved a substantial reduction in the total mud flat resource of northwest Europe and this in turn has greatly reduced the areas available to waders and waterfowl as feeding grounds. The reclamation of mud flats for grazing and arable land has occurred widely in the past. Today there is a likelihood of a significant proportion of the remaining mud land resource becoming lost to industry, water storage, and sewage effluent. (See also W79-07717) (Steiner-Mass)
W79-07720

SALT-MARSHES,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
W. G. Beeftink.
In the Coastline, p 93-121, 1977. Barnes, R. S. K. (ed.). John Wiley and Sons, New York.

Descriptors: *Salt marshes, *Marsh management, *Land reclamation, Wetlands, Marshes, Coastal marshes, Tidal marshes, Coasts, Drainage effects, Land use, Grazing, Sewage effluent, Geomorphology, Hydrogeology, Water pollution.

In temperate regions, salt marshes are found in and around river mouths, bays, Wadden areas, lagoons, and on coastal plains protected by sand- and shingle-spits. During marsh genesis, sedimentation of clay and silt takes place especially in the basins whilst coarser particles are deposited on the creek banks. The most common marsh use is grazing--usually by sheep, cows, and horses. Although mostly limited to the higher marshes and coastal dune-slacks, grazing may take up vast areas. Grazing includes selective cutting and removal of plant parts, local manuring, and trampling of the vegetation. The latter also leads to compaction of the topsoil, and, more intensified, to destruction of the turf-layer. Drainage of marshes is also another form of land reclamation. It results in a lowering of the water table and thus in changes in habitat, flora, and fauna. Transversing with ditches is harmful to the geomorphological development, for the natural watercourses may lose their function. Embankment is one of the most serious impacts on salt marshes. In industrialized areas, marshes are threatened by a complex array of man-made detritus, litter, and chemical substances derived from agricultural wastes, fertilizer or trash, urban sewage, and industrial effluents. (See also W79-07717) (Steiner-Mass)
W79-07721

ESTUARIES,
University Coll. of Swansea (Wales). Dept. of Botany.
A. Nelson-Smith.
In: The Coastline, p 123-146, 1977. Barnes, R. S. K. (ed.). John Wiley and Sons, New York.

Descriptors: *Estuaries, *Water pollution effects, *Management, Primary productivity, Water pollution, Sewage effluents, Organic matter, Oil wastes, Pesticide residues, Wastes, Chemical wastes.

The outstanding feature of estuaries is the high productivity which results from the constant supply of nutrients to a sheltered but dynamic habitat. Estuaries and tidal marshes are regarded as amongst the most fertile natural areas in the world--being up to seven times as productive as a typical wheat field and 20 times more than the open sea. Primary production probably lies in the region of 500 g of organic matter per square meter per annum. Physical pollution in estuaries often exaggerate conditions which are already present to some extent. Particulate wastes create turbidity and may damage gills when suspended, or blanket the bottom and may smother plants and sessile animals when settled. Organic waste decomposition may deplete the oxygen supply. Large discharges of sewage and industrial effluent may represent a sizable addition of fresh water. Oil pollution may depress photosynthesis in plants and bring about the faulty development of animal larvae, deter the more sensitive or delicate amongst mobile animals, and weaken those which are sedentary. (See also W79-07717) (Steiner-Mass)
W79-07722

PETROLEUM INDUSTRY IN THE DELAWARE ESTUARY,
Academy of Natural Sciences of Philadelphia, PA.
R. Patrick, and W. Whipple.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 962, Price codes: A19 in paper copy, A01 in microfiche. January 1977. 440 p.

Descriptors: *Oil industry, *Toxicity, *Delaware River, Oil wastes, Estuaries, Delaware, Industry wastes, Oily water, Shellfish, Economic costs, Fish, Marine animals.

A comprehensive evaluation was made of all of the sources of petroleum in the Delaware Estuary, including the finding that urban runoff and other unrecorded sources constitute a major part of the total land. Investigations of toxicity of petroleum and its products and derivatives to fish, shellfish, and other organisms have revealed that toxicity to most, but not all, immature organisms is greater than that to adults, that petroleum on sediments is much more toxic to oysters than petroleum dissolved in the water column, and chronic and life cycle studies show very much greater toxicity than the acute bioassay tests which are usually relied upon. Ultraviolet irradiation of No. 2 fuel oil and Iranian crude greatly increases their toxicity. The tracing of effects of a major spill indicates that mechanisms of transport may involve sediment-resuspension relationships which greatly modify relationships derived from previous hydrodynamic transport modeling. Economic, social, and institutional aspects are also covered. (Steiner-Mass)
W79-07725

TRACE AND TOXIC METAL UPTAKE BY MARSH PLANTS AS AFFECTED BY EH, PH, AND SALINITY,
Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
For primary bibliographic entry see Field 2K.
W79-07727

NATURAL RESOURCES OF COASTAL WETLANDS IN NORTHERN SANTA BARBARA COUNTY,
San Diego State Univ., CA. Center for Regional Environmental Studies.
C. R. Mahrdt, T. A. Oberbauer, J. P. Rieger, J. R. Verfaillie, and B. M. Browning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 994, Price codes: A06 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, Coastal Wetland Series No. 14, May 1976. 99 p, 12 fig, 1 tab, 45 ref, 7 append.

Descriptors: *Coastal marshes, *Natural resources, *Management, *Ecology, *Assessments, *California, Habitats, Ecosystems, Wetlands, Aquatic habitats, Estuaries, Estuarine environment, Tidal marshes, Land management, Land resources, Land use, Evaluation, Wildlife, Amphibians, Reptiles, Mammals, Birds, Fish, Invertebrates, Vegetation.

A one-year ecological assessment of Vandenberg Air Force Base was made to obtain baseline data on southern California coastal natural resource systems. Five major wetland systems are contained within the 35-mile coastline. Descriptions of the areas and their resources are given along with uses of the resources. Problems and conflicts of use are identified. Present management of the area is evaluated and recommendations made that will protect and enhance the natural resources of the coastal wetlands of northern Santa Barbara County. (Bollinger-Mass)
W79-07728

THE NATURAL RESOURCES OF CARPINTERIA MARSH, THEIR STATUS AND FUTURE. REPORT NUMBER 13 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
K. B. MacDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 993, Price codes: A06 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, March 1976. 69 p, 11 fig, 1 tab, 41 ref.

Descriptors: *Marsh management, *Natural resources, *Wildlife habitat, Marshes, *California, Resource development, Land use, Planning, Water pollution, Coastal marshes, Aquatic habitats, Wetlands, Carpinteria Marsh.

The natural resources of Carpinteria Marsh are documented and the uses that those resources receive are outlined. The problems and conflicts that affect the resources are enumerated and measures are recommended that will protect and enhance the marsh and its resources. It is intended as a guide for citizens, planners, and administrators. (Steiner-Mass)
W79-07729

THE NATURAL RESOURCES OF THE NIPOMO DUNES AND WETLANDS. REPORT NUMBER 15 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
K. A. Smith, J. W. Speth, and B. M. Browning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 995, Price codes: A07 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, June 1976. 106 p, 9 fig, 86 ref, 6 append.

Descriptors: *Coastal marshes, *Nipomo dunes, *Conservation, Wetlands, Salt marshes, Dunes, Lagoons, *California, Marshes, Natural resources, Marsh management, Land use.

Documented are the natural resources of an 18-square mile section of the coastal wetlands and dunes in southern San Luis Obispo and northern Santa Barbara counties. Also identified are the uses those resources receive, the problems affecting them, and recommendations for their conservation. The report is intended as a guide for planners, administrators, and all others concerned with the conservation of the area. (Steiner-Mass)
W79-07730

THE NATURAL RESOURCES OF MUGU LAGOON. REPORT NUMBER 17 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
K. B. MacDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 997, Price codes: A09 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Office of Biological Sciences, Washington, D.C., June, 1976. 119 p, 10 fig, 108 ref, 9 append.

Descriptors: *Wetlands, *California, *Marsh management, Lagoons, Natural resources, Land use, Water pollution, Conservation, Coastal marshes, Mugu Lagoon.

The purpose of this report is to document the natural resources of Mugu Lagoon, describe the uses that those resources receive, enumerate the problems that affect them, and recommend measures that will maintain and enhance the wetland. It is intended as a guide to those responsible for resource maintenance of the Lagoon as well as to provide information to those interested in the status and future of the lagoon. Existing and potential problems include: the restriction of tidal flow in the western lagoon arm by existing and/or planned roadways, possible overuse of the site by scientists and disruption of the natural lagoon community by introduced species. Other potential problems that may affect the future of the wetlands largely relate to off-site developments. These problems can be grouped into four categories: water pollution, sedimentation and flood control problems related to Calleguas Creek watershed; increasing urbanization of the agricultural lands surrounding the lagoons; increasing pressure for public recreational access; and a lack of coordinated management efforts. (Steiner-Mass)
W79-07732

THE NATURAL RESOURCES OF ANAHEIM BAY--HUNTINGTON HARBOUR. REPORT NUMBER 18 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
J. W. Speth, B. M. Browning, and K. A. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 998, Price codes: A07 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, August 1976. 103 p, 9 fig, 3 tab, 57 ref, 9 append.

Descriptors: *Marshes, *Anaheim Bay, *Marsh management, Wetlands, Salt marshes, Natural resources, Management, Land use, Industry, Planning, Water pollution, Dredging, Conservation, Wildlife habitat, Coasts.

All of the area's wetlands are in public ownership and thereby relatively protected from further developments. However, the indirect impact of development and other disturbances within the drainage area is a primary threat. To preserve and protect the remaining wetlands, and to help reestablish some of the wetland system, it is recommended that: dredging and filling except for harbor maintenance and wildlife habitat improvement, be prohibited, and lands adjacent to the eastern and northern boundaries of the wildlife refuge be designated for future addition to the refuge, A program of marsh restoration be instituted to allow tidal waters to flow unrestricted over all lands capable of being flooded within the station boundaries, the western island of Sunset Aquatic Regional Park be dedicated in its entirety to fish and wildlife use, Aeration devices be constructed in strategic locations of Huntington Harbour to assure survival of marine life during periods of low dissolved oxygen levels, and the existing problem of floating trash entering the Anaheim Bay marsh be investigated and a workable solution be determined and implemented. (Steiner-Mass)
W79-07733

VEGETATION OF THE ATLANTIC COASTAL RIDGE OF PALM BEACH COUNTY, FLORIDA,
Florida Atlantic Univ., Boca Raton, Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W79-07737

HYDROCHEMICAL EVIDENCE OF SEA WATER INTRUSION ALONG THE MAN-

GROL-CHORWAD COAST OF SAURASHTRA, GUJARAT,
Physical Research Lab., Ahmedabad (India).
B. I. Desai, S. K. Gupta, M. V. Shah, and S. C. Sharma.
Hydrological Sciences Bulletin, Vol. 24, No. 1, p 71-82, March 1979. 6 fig, 3 tab, 11 ref.

Descriptors: *Saline water intrusion, *Coasts, *Hydrogeology, *Water quality, Sea water, Salinity, Groundwater, Aquifers, On-site investigations, Chemical properties, Stratigraphy, Conductivity, Calcium, Sodium, On-site data collections, Foreign research, *India, *Gujarat State(India).

The rapid increase in the salinity of groundwater in the Mangrol-Chorwad area of coastal Saurashtra has been reported during the last decade. The geohydrological and chemical data of the principal aquifers in the region were examined with a view to ascertaining the cause of the increasing salinity in the groundwater of the region. It was shown that the field data are consistent with a simplified model in which limited amounts of sea water enter the limestone aquifer and the Na(+) from the mixed solution exchanges with the Ca(2+) in the aquifer matrix through the base exchange phenomenon. (Humphreys-ISWS)
W79-07752

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

HIGH FLUX PBI REVERSE OSMOSIS MEMBRANES FOR DESALINATION AND WATER REUSE,
Celanese Research Co., Summit, NJ.
M. Tan, and H. J. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 285, Price codes: A04 in paper copy, A01 in microfiche. Final Report, November 1978. 53 p, 15 fig, 16 tab. OWRT (No. 7527) (1), 14-34-0001-7527.

Descriptors: *Reverse osmosis, *Permselective membranes, Membranes processes, Desalination, Plastics, Polybenzimidazole.

High flux, high rejection flat polybenzimidazole (PBI) reverse osmosis membranes were prepared. Membrane film casting and processing parameters were first identified and optimized in small-scale laboratory film casting trials. On the basis of these thickness results, membranes measuring 12 in. by 36 in. and 2.5 mils in thickness were prepared and evaluated in long-term testing at 600 psi and 400 psi with non-chlorinated and chlorinated salt solutions. Two prototype spiral wound modules were fabricated for demonstration purposes. Membrane samples were tested in high pressure test cells against 5000 ppm salt solutions. In long-term testing, a decline in flux was observed, presumably the result of pressure induced compaction. Salt rejection remained high or improved slightly with time. In long-term testing against salt solutions containing 10 ppm chlorine, reduced water flux was observed after 1000 hours. Salt rejection remained well over 90%. The flux decline was attributed, in part, to membrane fouling and compaction.
W79-07571

3B. Water Yield Improvement

PROJECT SKYWATER: FISCAL YEARS 1975-78 REPORT.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Progress Report March 1979. 177 p, 15 fig, 12 ref, 4 append.

Descriptors: *Weather modification, *Cloud seeding, *Artificial precipitation, *Meteorology, Forecasting, Instrumentation, Environmental effects, Ecology, Social impact, Cloud physics, Hydrology, Ecosystems, Rainfall, Rainfall-runoff relationships, Model studies, Water resources development, Colorado River Basin, Orography, Contracts, Projects, Research and development.

Research conducted during the fiscal years 1975-1978 under the Bureau of Reclamation's precipitation management program is summarized. During this period the project was characterized by increasingly intensive efforts to reduce scientific uncertainty about the way in which precipitation develops and how science might influence the process beneficially. Project and contract summaries are presented for the Colorado River Basin Pilot Project, the High Plains Cooperative Program, the Sierra Cooperative Pilot Project, and the Colorado River Basin Program which is in preliminary planning. Contracts devoted to general orographic studies are summarized. The equipment developed in support of general atmospheric research, but not connected with any particular project, is described. Summaries are presented of several Project Skywater in-house investigations which explored the problems and concepts relevant to precipitation enhancement technology. (Davison-IPA)
W79-07514

MINIMIZING THE SALT BURDEN OF IRRIGATION DRAINAGE WATER IN THE PECOS VALLEY OF NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
G. A. O'Connor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 599, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Research Institute Report No. 105, 1979, 41 p, 10 fig, 7 tab, 21 ref. OWRT A-056-NMEX(2), 14-34-0001-7066.

Descriptors: *Irrigation practices, *Management, *Leaching, Salt balance, Drainage, Soil management, Salts, Leachate, Pecos River Valley, New Mexico.

The purpose was to evaluate the potential of minimized leaching management techniques under Pecos Valley, New Mexico conditions. The objectives were to determine the applicability of the U.S. Salinity Laboratory (USSL) computer model to New Mexico conditions, the effect of minimized leaching on soil and water properties, and the effect of minimized leaching on yield of a crop common to the Pecos Valley. Results show that the Pecos River Valley is ideally suited for minimized leaching management. Minimized leaching reduced the volume of water required for irrigation and also the volume and salt burden of drainage water without detrimentally affecting soil chemical and physical properties or crop yield. The USSL chemical computer model was applicable to Pecos Valley conditions and could be used to make long-term projections of actual field conditions resulting from a minimized leaching management program. (Stockton-N Mex)
W79-07714

MUNICIPAL AND INDUSTRIAL WATER CONSERVATION - THE FEDERAL GOVERNMENT COULD DO MORE,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07881

WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07882

3C. Use Of Water Of Impaired Quality

OVERCOMING LEGAL AND INSTITUTIONAL BARRIERS TO PLANNED REUSE OF WATER IN THE COLORADO RIVER BASIN,
Denver Research Inst., CO. Industrial Economics Div.
For primary bibliographic entry see Field 6E.
W79-07502

SECURING AGRICULTURAL LAND FOR WASTEWATER IRRIGATION,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 776, Price codes: A07 in paper copy, A01 in microfiche. Report, 1977. 135 p, 5 fig, 18 tab, 45 ref, 3 append.

Descriptors: *Return flow, *Irrigation, *Agriculture, *Legal aspects, *Irrigation programs, Waste water disposal, Water reuse, Economics, Evaluation, Reservoir storage, Dairy industry, Application methods, Waste water treatment, Municipal wastes.

An examination of land application of waste water from Petaluma, California, to agricultural land for irrigation included an investigation of methods for obtaining land for waste water disposal. The agricultural irrigation plan was considered to provide wastewater disposal and more efficient use of available water resources, provide long-term preservation of open space, and maintain a dairy industry by supplying locally grown fodder crops. Two potential areas for waste water irrigation were identified to the east and to the southeast of the city. One irrigation plan considered would dispose of treated effluent on fields in the summer and discharge waste water to the Petaluma River in the winter; this procedure would require about 1,400 acres. The second configuration would transfer waste water from the treatment plant to a reservoir where it would be contained in winter and distributed to agricultural fields in summer; this alternative would require about 3,800 acres. The legal interests in the land analyzed included: fee simple, lease, easement, development rights, license, covenant running with the land, contract, option for future needs, and right of first refusal; fee simple, lease, and easement were considered to have the most potential. A series of purchasing and leasing arrangements for securing land for waste water irrigation were then evaluated. (Lisk-FRC)
W79-07796

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

3D. Conservation In Domestic and Municipal Use

OPTIMUM LAWN WATERING RATES FOR ESTHETICS AND CONSERVATION,
Tudor Engineering Co., Riverton, WY.; and Wyoming Univ., Laramie. Div. of Agricultural Engineering.
J. Barnes, J. Borrelli, and L. Pochop.
Journal of the American Water Works Association, Vol. 71, No. 4, p 204-209, April 1979. 3 fig, 7 tab, 5 ref. OWRT B-035-WYO (4), 14-34-0001-7201.

Descriptors: *Lawns, *Water demand, *Water conservation, *Wyoming, Municipal water, On-site investigations, On-site data collections, Data processing, Evapotranspiration, Soil water, Grasses, Water utilization, Water users, Irrigation, Rates of application, Sprinkling, Sprinkler irrigations, Optimization, *Lawn watering.

It is known that lawn watering comprises a relatively large percentage of municipal water use, but few data exist on individual home lawn water application rates with respect to the esthetic appearance of lawns. This study showed that an esthetically pleasing lawn can be achieved with an average water application rate equal to or less than the seasonal evapotranspiration rate. A homeowner education program was advocated to promote self-rationing during water-short periods. (Sims-ISWS)
W79-07746

REDUCTIONS IN WATER CONSUMPTION AND FLOW OF SEWAGE - REPORT TO CONGRESS.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5F.
W79-07785

MUNICIPAL AND INDUSTRIAL WATER CONSERVATION - THE FEDERAL GOVERNMENT COULD DO MORE,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07881

3E. Conservation In Industry

FEASIBILITY STUDY OF WASTE WATER RECOVERY IN SHRIMP PROCESSING PLANTS,
For primary bibliographic entry see Field 5D.
W79-07794

MUNICIPAL AND INDUSTRIAL WATER CONSERVATION - THE FEDERAL GOVERNMENT COULD DO MORE,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07881

3F. Conservation In Agriculture

LEVEL-BASIN IRRIGATION: A METHOD FOR CONSERVING WATER AND LABOR,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
L. J. Eric, and A. R. Dedrick.
Available from U.S.G.P.O., Washington, D.C., Stock No. 001-000-03912-1. Farmers Bulletin No. 2261, April 1979. 23, 17 fig, 2 tab.

Descriptors: *Irrigation systems, *Irrigation design, *Irrigation effects, *Irrigation efficiency, Irrigation operation and maintenance, Irrigation engineering, Surface irrigation, Turnouts, Maintenance, Hydraulic gates, Outlets, Erosion control, Level-basin irrigation.

Level-basin irrigation, a gravity method whereby water is supplied to level soil surfaces over a short period of time, involves application of water to a level area of any shape surrounded by a control barrier such as a dike. Water applied to basins over a short period of time is confined until absorbed by the soil. This type of system has many characteristics which can result in high irrigation efficiency, and offers advantages over other more commonly used techniques. These advantages include: minimizing of deep percolation, application efficiencies above 90% on fine textured soils, natural leaching of salts, is adaptable to automation and to furrows as well as flatbed crops, and large streams of water can be utilized, thereby reducing irrigation time and labor requirements. The limitations of this method include: the difficulty of precision leveling necessary for even water distribution, ascertaining the correct amount of water, the amount of land leveled is limited by the depth of topsoil, and elaborate erosion control measures may be required with the use of a large stream. The basic principles and design in land preparation are set forth, and evaluations of two field trials are discussed. Gates and outlet structures, cultural practices, and management are examined. Diagrams of field plans are provided. (Davison-IPA)
W79-07506

MINIMIZING THE SALT BURDEN OF IRRIGATION DRAINAGE WATER IN THE PECOS VALLEY OF NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
For primary bibliographic entry see Field 3B.
W79-07714

IRRIGATED CORN YIELD RESPONSE TO WATER,
Southwestern Great Plains Research Center, Bushland, TX.
For primary bibliographic entry see Field 2I.
W79-07793

HARVESTING RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas Agricultural Experiment Station, Manhattan.
H. L. Manges, and L. T. Mao.
Paper No. 78-2559, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 10 p. 2 fig, 3 tab, 10 ref, 11 equ. ASAE, St. Joseph, Michigan.

Descriptors: Water harvesting, Runoff, Precipitation(Atmospheric), *Tailwater, Climatic data, Model studies, Evapotranspiration, Water balance, Corn, *Irrigated land.

A tailwater management model was developed to simulate runoff from precipitation on irrigated land. The model was tested for corn using 25 years of climatological data for Garden City, Kansas. Runoff from precipitation repumped onto the field averaged 69 and 39 millimeters annually for two commonly irrigated soils. (Skogerboe-Colorado State)
W79-07890

EVALUATION OF CROP WATER STRESS UNDER LIMITED IRRIGATION,
Science and Education Administration, Fort Collins, CO. Agricultural Research.
For primary bibliographic entry see Field 2I.
W79-07892

RE-EMERGENCE OF A CONTROVERSY: ENFORCING ACREAGE LIMITATION,
For primary bibliographic entry see Field 6E.
W79-07900

ACREAGE AND RESIDENCY LIMITATIONS IN THE IMPERIAL VALLEY: A CASE STUDY IN NATIONAL RECLAMATION POLICY,
For primary bibliographic entry see Field 6E.
W79-07902

DIGITAL CONTROLLER FOR TRICKLE IRRIGATION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
D. D. Fangmeier, and J. D. Busman.
Paper No. 78-2547, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, Palmer House Hotel, Chicago, Illinois, 7 p, 5 fig, 1 tab, 5 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Control systems, Irrigation systems, Water conservation, Electronic equipment, Evaporation, Soil moisture, Moisture tension, Timing, Consumptive use, Application equipment, *Trickle irrigation.

A digital controller was designed using complementary metal oxide semiconductor electronics. The controller uses measured evaporation pan depths and soil moisture tensions to determine the time required to apply the desired quantity of water on a daily basis. Circuit diagrams for major components were presented. (Skogerboe-Colorado State)
W79-07935

ELECTRONIC TIMERS FOR AUTOMATED SURFACE IRRIGATION SYSTEMS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
H. D. Fisher, A. S. Humpherys, and R. V. Worstell.
Paper No. 78-2544, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 7 p. 3 fig, 5 ref. ASAE, St. Joseph, Michigan.

Descriptors: Surface irrigation, Automatic control, *Control systems, Automation, Timing, Electronic equipment, Instrumentation, *Furrow irrigation, Irrigation systems.

Electronic timers were developed to replace alarm clocks and mechanical timers for semiautomated irrigation structures and valves. Timer-controllers including a micro-processor unit were designed for a field tested with automatic cutback, buried lateral and multiset furrow irrigation systems. (Skogerboe--Colorado State)
W79-07989

A COMPUTER SIMULATION OF SOIL WATER DISTRIBUTION USING THE PULSED DRIP IRRIGATION METHOD AT LOW AND HIGH DISCHARGE RATES ON A SANDY SOIL,
Fruit and Fruit Technology Research Inst., Stellenbosch (South Africa).
F. C. Van Rooyen, P. C. Van Rooyen, and I. Levin.
Water S. A., Vol. 5, No. 1, p 44-56, January 1979. 10 fig, 1 tab, 7 ref.

Descriptors: *Irrigation, *Computer models, *Irrigation effects, *Irrigation efficiency, *Irrigation programs, *Sands, Soil physical properties, Soil water movement, Soil-water-plant relationships, Equations, Mathematical studies, Rates of application, Water spreading, Water distribution, Percolation, Evapotranspiration, Water loss.

A regic sand typical of large areas of the western cape of South Africa was used with a previously verified computer simulation model to study continuous and pulsed drip irrigation rates with respect to vertical and horizontal soil water distribution. Pulsed and continuous irrigation application rates of 1.5 l/hour, 3 l/hour and 9 l/hour were simulated, and a total of 12 l of water was added in each case. All applications were simulated up to a time of 24 hours which included varying time intervals of redistribution after terminating water application. Calculations of soil water distribution were made using a two-dimensional water transport model expanded to include salt. The method for solving the flow equation is presented. The calculations were performed with a FORTRAN program and executed on a Burroughs 7700 computer. The studies showed that the differences between pulsed and continuously applied drip irrigation decreased with increasing discharge rate. For regic sand a 3 l/hour pulsed irrigation yielded the same results as 1.5 l/hour continuously applied with regard to deep percolation losses below 0.6m deep. Differences between pulsed and continuous application were insignificant for this soil at a discharge rate of 9 l/hour. The results showed that a 3 l/hour pulse treatment would be the most suitable where a peak water consumption of 20 to 40 l/plant was determined. (Davison-IPA)
W79-07995

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

A RESERVOIR OPERATING MODEL WITH INORGANIC QUALITY CONSTRAINTS FOR THE TRUCKEE RIVER,
Boyle Engineering Corp., Las Vegas, NV.; and Nevada Univ. System, Las Vegas Desert Research Inst.
T. D. Chiatovich, and J. W. Fordham.
Water Resources Bulletin, Vol. 15, No. 2, p 301-315, April 1979. 4 fig, 1 tab, 5 ref. OWRT (No. 5216) C-6157 (1), 14-31-0001-5216.

Descriptors: *Reservoir operation, *Water quality, *Low-flow augmentation, *Computer models, *Simulation analysis, *Optimization, Evaluation, Feasibility, Standards, Digital computers, Dynamic programming, Reservoir releases, Constraints,

Downstream, Water demand, River basins, Decision making, Systems analysis, Truckee River(Cal Nev), Inorganic, Iterative process, Worth maximization, Costs.

Investigated was low-flow augmentation as a means of meeting inorganic water quality standards for the Truckee River at the California-Nevada state line. A digital inorganic water quality model was combined with a deterministic dynamic reservoir operating model in an iterative process which allowed the optimization of releases subject to selected inorganic water quality constraints as well as downstream demands. The water quality model was a modification of a previously developed chemical water quality model for the Truckee River; estimates of the chemical quality of unregulated inflows or gains to the main river channel were made using regression equations exponentially relating quality and flow. The reservoir operating model was a deterministic dynamic programming model whose objective function was to maximize the total worth of releases considering water quality constraints as well as downstream water demands. Results from model runs with varied flow and river loading data have indicated that flow augmentation may be a feasible and relatively inexpensive way of meeting standards for this system, except in time of severe drought. (Bell Graf-Cornell)
W79-07562

RHYTHMIC SPACING AND ORIGIN OF POOLS AND RIFFLES,
California Univ., Santa Barbara. Dept. of Geological Sciences.
E. A. Keller, and W. N. Melhorn.
Geological Society of America Bulletin, Vol. 89, p 723-730, May 1978. 12 fig, 4 tab, Doc. No. 80509. OWRT B-089-NC (7) and A-021-IND (6), 14-34-0001-6103.

Descriptors: *Pools, *Riffles, Alluvial stream channels, Stream improvement, Stream stabilization, Meanders, Stream alignment, Fluvial geomorphology.

Quantitative analysis of the spacing of pools in bedrock and alluvial stream channels in California, Indiana, Virginia, and North Carolina suggest that the tendency for streams to meander in the vertical (or third) dimension, as in the horizontal plane, is a fundamental characteristic of many streams that is independent of material type. Simple linear-regression and correlation models reveal that approximately 70% of the variability of the spacing of pools can be explained by the variability of channel width. Analysis of the spacing of 251 pools in eleven streams, utilizing the Kolmogorov-Smirnov goodness of fit test and one-way analysis of variance suggests that the hypothesis that the data from bedrock and alluvial channels are from the same population cannot be rejected at the 0.05 level of significance. Morphologic maps and field observations of stream channels incised in sandstone, limestone, metavolcanic rock, and syenite suggest that although these streams have much in common with alluvial stream channels, there exist considerable differences in certain aspects of channel morphology. This results because bedrock control of morphology locally may be more significant than the effects of general processes that tend to produce rhythmic channel forms such as pools and riffles. However, local controls tend to mask rather than destroy the effects of more general processes that produce the third dimension of meandering streams. (Kiger-North Carolina)
W79-07566

POOLS, RIFFLES, AND CHANNELIZATION,
California Univ., Santa Barbara. Dept. of Geological Sciences.
E. A. Keller.
Environmental Geology, Vol. 2, No. 2, p 119-127, 1978. 6 fig, 3 tab, 22 ref. OWRT B-089-NC (6), 14-34-0001-6103.

Descriptors: *Channel improvement, Geomorphology, Channel morphology, Channelization, Channel erosion, Stream improvement, Stream stabilization, Urban streams.

The addition of regularly spaced deeps (pools) and shallows (riffles) that provide a variety of flow conditions, areal sorting of stream-bed material, cover for wildlife, and a positive aesthetic experience, may be desirable in many channel projects. Such designs will reduce adverse environmental impacts of stream channel modifications. Analysis of variance for pool-to-pool spacing data suggests that there is no significant difference with respect to channel width between pools that form in natural streams and those in streams affected by a variety of human uses. Short of channelization, which changes the channel width, pools and riffles, within limits are not particularly sensitive to environmental stress. Experiments in Gum Branch near Charlotte, North Carolina, support the hypothesis that channel form and process evolve in harmony and that manipulation of cross-channel morphology can influence the development of desired channel processes. Planned manipulation of its channel form induced Gum Branch to develop as desired. Morphologic stability consisting of incipient point bars, pools, and riffles was maintained over a period of high magnitude flood events, only to be degraded later by a wave of sediment derived from upstream construction and stream-bank failures. Thus, environmentally desirable channel morphology in urban streams cannot remain stable if changes in the sediment load or storm-water runoff exceed the limits of the stream's ability to make internal adjustments while maintaining morphologic stability. (Kiger-North Carolina)
W79-07567

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NON-POINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
W. B. Davey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 411, Price codes: A16 in paper copy, A01 in microfiche. June, 1977, 349 p.

Descriptors: *Environmental control, *Water pollution control, *Water management(Applied), *Regulation, Pollutant identification, Pollution abatement, Erosion, Farm wastes, Federal water pollution control act, Feed lots, Soil conservation.

In its various issuances the federal Environmental Protection Agency (EPA) has recognized that: (1) The basic approach to non-point source pollution control is prevention, and (2) Local entities such as conservation districts should assume a leading role in planning and implementing the programs. Potential conservation district involvement in the preparation and implementation of state and areawide water quality management plans is developed pursuant to Section 208 of the 1972 Federal Water Pollution Control Act Amendments (P.L. 92-500). The non-point pollution source aspects of erosion and sediment control, animal waste management (organics), and irrigation water management (salts) are emphasized. The preparation of management plans is included which EPA indicates should be directed to meet two principal mandates of the Act: (1) The determination of effluent limitations needed to meet applicable water quality standards, including the requirement to at least maintain existing water quality (Section 303); and (2) Development of state and areawide management programs to implement abatement measures for all pollutants sources. (Vloedman-Florida)
W79-07886

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

WATER RIGHT LAWS AS THEY AFFECT LAND ACQUISITION AND CONSTRUCTION,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
C. C. Bowman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 901, Price codes: A03 in paper copy, A01 in microfiche. Report No. NSF-RA-E-74-095, January, 1974, 36 p.

Descriptors: *Water law, *Legislation, *Water rights, *Land development, Regulation, Recreation facilities, Land use, Environmental effects, Regional development, Water users.

This report is divided into three sections. The first presents the customs, laws and federal-state relationships which must be considered when acquiring land and water for recreational facilities. Guidelines are provided for the search to be conducted, to determine the feasibility of water supply and the responsibilities relevant to water and ditch rights. The histories of United States and Montana Water Law are presented including court decisions and existing laws. The second study examines important factors involving water balance, water rights, ditch rights and authority over water, which must be considered before land is purchased, leased or acquired for recreational development. The third part discusses the Gallatin Canyon water rights study. Research objectives include: (1) studying the surface water laws governing water use; (2) determining the existing surface water usage on the Gallatin River above Spanish Creek; (3) determining which governmental agency has the final authority over such waters; (4) determining to necessary studies and procedures required before a recreational area and the supporting commercial facilities can be developed. (Vloedman-Florida)
W79-07891

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 257, Price codes: A02 in paper copy, A01 in microfiche. March 23, 1977, 16 p.

Descriptors: *Water resources planning act, *Water requirements, *Water resources, Assessments, Water management, Use rates, Water districts, Data collections, Water users, Regulation, Water demand.

The 1965 Water Resources Planning Act (Act) require the Water Resources Council (Council) to prepare an assessment biennially, or less frequently as the Council may determine of the adequacy of water supplies necessary to meet the requirements in each United States water resource region. Results are presented of a General Accounting Office (GAO) review of the Water Resources Council's efforts to develop a national water assessment pursuant to section 102 of the Act. Problems came to the GAO's attention which raised doubts about the reliability and usefulness of the 1975 assessment, Federal, State and regional agencies were unable to resolve discrepancies in the water data for base year 1975. Steps should be taken to make the final assessment document more responsive to the needs of the intended user agencies. Before undertaking future assessments, the Council should reappraise the project's objectives and the methodology of developing an adequate national water data base. (Vloedman-Florida)
W79-07893

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

4B. Groundwater Management

CONNECTOR WELL EXPERIMENT TO RECHARGE THE FLORIDAN AQUIFER, EAST ORANGE COUNTY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div.
P. W. Bush.
Geological Survey Water-Resources Investigations 78-73 (open-file report), 1979. 40 p, 18 fig, 1 tab, 10 ref.

Descriptors: *Artificial recharge, *Aquifers, *Groundwater recharge, *Orifices, *Aquicludes, Drilling, Transmissivity, Methodology, Aquifer characteristics, Evaluation, Florida, *Floridan aquifer, *Connector wells.

An experimental connector well, screened in the shallow sand aquifer, finished with open hole in the Floridan aquifer, and cased through the confining layer between the two aquifers, was drilled in east Orange County, Florida, to obtain information on the nature and function of the shallow aquifer as related to connector well operation. The potentiometric surface of the shallow aquifer is about 45 feet higher than the potentiometric surface of the Floridan aquifer; hence water flows by gravity from the shallow aquifer to the Floridan aquifer through the well 'connecting' the two aquifers. Continuous flow measurement over 10 months shows the well discharge varies seasonally and averages slightly more than 50 gallons per minute. Observation wells show that, except for seasonal variation water levels within the area of influence have reached steady state within measurable limits. Vertical anisotrophy in the shallow aquifer is apparently caused by the shape and (or) arrangement of the sand grains that comprise the shallow aquifer, rather than distinct confining layers of different lithology. Transmissivity of the shallow aquifer at the site is about 600 square feet per day. Extensive dewatering of wetlands in east Orange County by connector wells alone is probably not feasible. Nevertheless, large amounts of water could be channeled to the Floridan aquifer by connector wells. The results of the connector well experiment imply that water is being captured from evapotranspiration and runoff in the vicinity of the connector well. (Woodard-USGS)
W79-07705

FINAL REPORT ON FATE OF METALS APPLIED IN SEWAGE AT LAND WASTEWATER DISPOSAL SITES,
Texas A and M Research Foundation, College Station.
For primary bibliographic entry see Field 5B.
W79-07789

TREATMENT OF PRIMARY SEWAGE EFFLUENT BY RAPID INFILTRATION,
Corps of Engineers, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5D.
W79-07792

WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07882

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07893

UPDATING GROUNDWATER LAW: NEW WINE IN OLD BOTTLES,
For primary bibliographic entry see Field 6E.
W79-07894

GROUNDWATER - A FILTER FOR A MUDDY ISSUE. (LANDOWNERS' RIGHTS TO GROUNDWATER AS GOVERNED BY THE NEBRASKA PREFERENTIAL USE STATUTE),
For primary bibliographic entry see Field 6E.
W79-07913

MAP SHOWING GENERAL AVAILABILITY OF GROUND WATER IN THE KAIPAROWITS COAL-BASIN AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
D. Price.
Available from Branch of Distribution, USGS Box 25286, Fed. Ctr. Denver CO 80225 price $1.50. Geological Survey Miscellaneous Investigations Series Map I-1033-B, 1977. 1 sheet.

Descriptors: *Groundwater availability, *Hydrogeology, *Maps, *Aquifer characteristics, *Water levels, Water quality, Water yield, Utah, *Kaiparowits coal-basin area.

This is one of a series of maps that describe the geology and related natural resources of the Kaiparowits coal-basin area, Utah. The map is based partly on records of water wells, springs, and coal and petroleum-exploration holes, partly on unpublished reports of field evaluations of prospective stock-water well sites by personnel of the U.S. Geological Survey, and partly on a 6-day field reconnaissance by the writer. Rocks ranging in age from Permian to Holocene are exposed in the Kaiparowits coal-basin area. They consist chiefly of sedimentary rocks--mostly interbedded sandstone, siltstone, shale, conglomerate, and limestone strata--in aggregate a thickness of several thousand feet. The minimum expected yields of individual wells shown on the map assume that the wells are at least 6 inches in diameter; fully penetrate the aquifer; either have no casing, perforated casing, or well screens opposite the aquifer; and are equipped with optimal pumping equipment. The yields shown are those that could be sustained indefinitely by pumping. The ranges of expected depth to ground water shown on the map are based on measured and reported depths of water in wells. Yields of most springs range from less than 1 to about 20 gallons per minute, but several springs discharge more than 100 gallons per minute. Much of the ground water (including springflow) may be too saline to drink. (Woodard-USGS)
W79-07938

USE OF STORM-WATER BASINS FOR ARTIFICIAL RECHARGE WITH RECLAIMED WATER, NASSAU COUNTY, LONG ISLAND, NEW YORK--A HYDRAULIC FEASIBILITY STUDY,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Aronson, T. E. Reilly, and A. W. Harbaugh.
Long Island Water Resources Bulletin 11, 1979. 57 p, 17 fig, 9 tab, 24 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Reclaimed water, *Storm runoff, *Infiltration, Model studies, Methodology, Computer models, Simulation analysis, Watersheds(Basins), Control drainage, Water table, *Long Island(NY), Dual-purpose basins.

A survey of 205 storm-water basins in Nassau County, N.Y. shows that 14 of the 50 largest basins would be suitable for dual infiltration of reclaimed water and storm runoff. Each basin would be divided by an earthern partition so that half would be used for storm-water retention, the other half for reclaimed water. The 14 basins together could accommodate 38.6 million gallons per day of reclaimed water at infiltration rates as high as 0.28 feet per hour, which is approximately 20 percent of the basins' theoretical maximum infiltration capacity. However, the basins cannot accommodate the amounts needed to offset the ground-water deficit predicted for the 1990's in Nassau County. The tendency of certain basins to overflow during large-magnitude storms could be reduced by enlarging the basins to accommodate excess runoff, lowering the height of the dividing partition, diverting excess runoff to another basin, or temporarily halting inflow of reclaimed water. The regional water-table rise that would result from artificial recharge at the 14 selected basins would partly offset the decline in the water table and in streamflow caused by sewering in parts of Nassau and Suffolk Counties. (Woodard-USGS)
W79-07948

CHANGES IN VEGETATION DIVERSITY CAUSED BY ARTIFICIAL RECHARGE,
Geological Survey, Tucson, AZ. Water Resources Div.
T. E. A. van Hylckama.
Vegetatio, Vol. 39, No. 1, p 53-57, 1979. 3 fig, 2 tab, 16 ref.

Descriptors: *Plant groupings, *Artificial recharge, *Ecotypes, *Distribution patterns, *Recharge ponds, Balance of nature, Grasslands, Pre-impoundment, Post-impoundment, *Lubbock(TEX), *Zandvoort(Netherlands), Plant sociology, Plant taxonomy.

Efforts to increase the rate of artificial recharge through basins often necessitates scraping and ditching before and during operations. Such operations can result in more or less drastic changes in vegetation (depending on what was there before), characterized by diminished numbers of species and lowered diversity. Two examples, one from the Netherlands and one from Texas are presented showing how similar treatments cause similar changes in two completely different plant societies. (Woodard-USGS)
W79-07951

MODELLING SUBSURFACE IRRIGATION RETURN FLOW,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
S. R. Singh.
In: Hydrology Research Division, Annual Progress Reports and Short Research Notes, 1977-78, p 62-67, 1979. 1 fig, 3 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. HR 76-4.

Descriptors: *Groundwater recharge, *Mathematical models, *Irrigation, Soil-water-plant relationships, Drainage effects, Irrigation methods, Aquifers, Equations, Computer programs, Computer models, Simulation analysis, Subsurface irrigation, Subsurface flow, Groundwater flow.

A study was conducted to (1) develop a mathematical model for predicting groundwater recharge from irrigation taking into account the soil-plant-atmosphere interactions and the methods of irrigation; (2) develop an aquifer simulation model for quantitative analysis of groundwater flow toward the drainage facilities; and (3) validate the models through the use of the soil moisture and groundwater data collected at the Irrigation Experiment Project in Alberta. Models were developed separately for different components and then connected in a computer program. The differential equation of groundwater flow through an inhomogeneous, unconfined, two-dimensional aquifer is presented along with the solution procedure. This solution procedure completes the development of a finite element model for simulating two-dimensional, transient-free surface groundwater flow through actual acquifers. The temporal distribution of subsurface irrigation return flow, subject to different rates of groundwater recharge resulting from sprinkler or surface flooding irrigation, can be predicted with this model. (Davison-IPA)
W79-07958

HYDROGEOLOGY OF IRRIGATION RETURN FLOW,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
A. Vandenberg.
In: Hydrology Research Division, Annual Progress Reports and Short Notes, 1977-78, p 68-80, 1979. 4 fig, 3 tab, 2 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. HR 77-1.

Descriptors: *Hydrology, *Irrigation effects, *Hydrogeology, *Groundwater recharge, *Piezometers, Groundwater flow, Measurement, Instrumentation, Testing, On-site tests, Bedrock, Groundwater barriers, Infiltration, Irrigation water, Vauxhall(Alberta, Canada), Oldman

River(Alberta, Canada), Bow River(Alberta, Canada).

During 1977 the first phase of the project to be completed involved the drilling, logging and testing of two 122 m test holes to obtain preliminary information on subsurface geology and groundwater conditions. Seven piezometer nests, each having three piezometers were installed in the test holes. The regional hydrogeology and the geologic setting of the Vauxhall irrigation return flow study area in southeastern Alberta are described. The second phase of the field work included infiltration and limited pump tests on each piezometer. A sand and gravel layer within the surface deposits encountered at all piezometer nest locations appears to be continuous over the area, and occurs at the same distance above the surface of the bedrock The drillhole information indicates that the bedrock divide lies to the north of the topographic divide. If this is the case, groundwater seepage would tend to be diverted along the surface of the bedrock towards the Oldman River instead of toward the Bow. The estimates of permeability for the strata around the tips of the piezometers are based on the results of both the long-term infiltration and the short-term pumping tests. The permeability values presented are indicative of the relative permeability for the different strata; they are not absolute values. (Davison-IPA)
W79-07959

4C. Effects On Water Of Man's Non-Water Activities

MONITORING SPAWNING GRAVEL IN MANAGED FORESTED WATERSHEDS, A PROPOSED PROCEDURE,
Corvallis Environmental Research Lab., OR. Ecosystems Modeling and Analysis Branch.
For primary bibliographic entry see Field 5C.
W79-07503

THE COASTLINE,
For primary bibliographic entry see Field 2L.
W79-07717

THE COASTLINE,
Saint Catharine's Coll., Cambridge (England). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W79-07718

MUDDY FORESHORES,
Nature Conservancy Council, Hampshire (England).
For primary bibliographic entry see Field 2L.
W79-07720

PETROLEUM INDUSTRY IN THE DELAWARE ESTUARY,
Academy of Natural Sciences of Philadelphia, PA.
For primary bibliographic entry see Field 2L.
W79-07725

THE NATURAL RESOURCES OF CARPINTERIA MARSH, THEIR STATUS AND FUTURE. REPORT NUMBER 13 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W79-07729

THE NATURAL RESOURCES OF THE NIPOMO DUNES AND WETLANDS. REPORT NUMBER 15 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07730

THE NATURAL RESOURCES OF MUGU LAGOON. REPORT NUMBER 17 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W79-07732

THE NATURAL RESOURCES OF ANAHEIM BAY--HUNTINGTON HARBOUR. REPORT NUMBER 18 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07733

DEVELOPER'S HANDBOOK,
Connecticut Dept. of Environmental Protection, Hartford. Coastal Area Management Program.
For primary bibliographic entry see Field 6B.
W79-07735

COAL MINE WATER POLLUTION - LEGAL AND REGULATORY ISSUES: A SURVEY,
For primary bibliographic entry see Field 5B.
W79-07887

WATER RIGHT LAWS AS THEY AFFECT LAND ACQUISITION AND CONSTRUCTION,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
For primary bibliographic entry see Field 4A.
W79-07891

WATER WAY PRESERVATION: THE WILD AND SCENIC RIVERS ACT OF 1968,
For primary bibliographic entry see Field 6E.
W79-07895

HARBOR LINES AND THE PUBLIC TRUST DOCTRINE IN WASHINGTON NAVIGABLE WATERS,
Washington Univ., Seattle. School of Law.
R. W. Johnson, and E. M. Cooney.
Washington Law Review, Vol. 54, No. 2, p 275-314, 1979.

Descriptors: *Shore protection, *Washington, *Legislation, Regulation, Water law, Water management, Water policy, Harbors, Coastal engineering, Zoning.

Since 1971, the Shoreline Management Act has been the dominant legal tool for managing the Washington coastal zone. However, use of state-owned beds of navigable fresh and salt waters below low tide or the low-water line are still controlled by the harbor line system established in the 1889 state constitution. The relationship of the harbor line system to the Shoreline Management Act, to the various federal laws concerned with the coastal zone, and to the public trust doctrine are analyzed. The origin, development, and operation of the system in Washington are described. Federal and state legislation and court opinions concerned with the problem of controlling uses of navigable waters and beds in Washington are surveyed. These laws and decisions have: (1) preserved water surfaces and beds for water-related uses by curbing filling and construction; (2) protected the environmental and aesthetic qualities of these areas; (3) developed priorities for future uses; and (4) established governmental regulatory systems for controlling development and activities. Washington's Harbor Line System and comments on the Seattle central waterfront controversy are also examined. (Vloedman-Florida)
W79-07897

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

4D. Watershed Protection

A FINITE-ELEMENT MODEL OF OVERLAND AND CHANNEL FLOW FOR ASSESSING THE HYDROLOGIC IMPACT OF LAND-USE CHANGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
B. B. Ross, D. N. Contractor, and V. O. Shanholtz.
Journal of Hydrology, Vol. 41, p 11-30, 1979. 7 fig, 4 tab, 30 ref. OWRT A-062-VA (5).

Descriptors: *Land use, *Finite element analysis, Surface flow, Mathematical models, Watersheds, Flood hydrographs, Overland flow, Channel flow.

This report presents a method of determining the hydrologic impact of land-use change on a watershed. With precipitation excess as input, the finite-element technique, utilizing Galerkin's residual method, was used to route mathematically overland and channel flow. The nature of the model allowed land-use changes to be easily incorporated into the model. A hypothetical watershed and an imaginary storm were used to obtain initial flood hydrographs. Several arbitrary land-use changes were then made and their effect upon the response of the watershed system determined.
W79-07565

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

CONTROLLING SEDIMENT DAMAGE,
Prince George's County Government, MD.
T. H. Secor.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 174-178, 3 tab. Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.

Descriptors: *Sediments control, *Erosion control, *Water pollution sources, *Water quality standards, Soil types, Suspended solids, Turbidity, Flow rates, Land use, Agriculture, Construction, Soil conservation, Soil management, Rainfall-runoff relationships, Ecology, Soil properties, Soil stabilization, Potomac River basin.

Nonpoint source pollution varies in quantity and quality, is associated with runoff generated by storm events, and comes from diffuse sources. Setting standards for controlling sediment from nonpoint sources is difficult, because the problems involved in setting such standards are complex. The background levels of pollutants in streams and rivers vary from one region to another and from one river to another. Soils in different areas and climates are geologically different, and contribute to different water quality. Total suspended solids (TSS) and turbidity vary with flow rates, land use practices, rainfall intensity, and the effects of TSS and turbidity on aquatics. In accounting for these variabilities, standards must protect the biosphere from harmful concentrations, and should be tailored for each stream segment. Agriculture has traditionally been involved in erosion control, but is still the greatest contributor of sediment in the Potomac basin because it occupies a great portion of the basin. Control measures used by the construction sector in the Maryland-Virginia-Washington, D. C. area include diversion dikes, gravel outlet structures, straw bale barriers, sediment traps, temporary seedlings, and sediment basins, the latter being the most effective. Local ordinances controlling erosion from construction sites have been in effect in the Washington area for many years; other states have adopted manditory erosion and sediment control programs which have proven to be effective. (Davison-IPA)
W79-07990

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EVALUATING POLLUTION STRESS ON ECOSYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
K. L. Dickson, J. Cairns, Jr., J. R. Clark, and J. H. Rodgers.
In: The Freshwater Potomac: Aquatic Communities and Environmental Stress, p 80-83, 1978. 1 fig, 3 tab, 5 ref. Flynn, K. C., and Mason, W. T., Eds.. Interstate Commission on the Potomac River Basin. E-(40-1) 4939.

Descriptors: *Eutrophication, *Water pollution, *Environmental effects, *Ecosystems, Primary productivity, Photosynthesis, Aquatic microorganisms, Periphyton, Biomass, Measurement, Sulfates, Carbon, Aquatic life, Algae, Assay, Laboratory tests, Pollutant identification.

Some approaches to assessing pollutant impacts on ecosystem functions are discussed. Research activities conducted by the Aquatic Ecology Group at Virginia Polytechnic Institute have been confined to the development of methods to measure in situ C14 and S35 uptake by Periphyton (Aufwuchs) and an evaluation and adaptation of methods to measure living biomass of the Periphyton community. Measurements of the primary production of this community were made on natural and artificial substrates. An assay of S35 gave an estimate of the autotrophic versus the heterotrophic biomass of this complex community. The assimilatory sulfate reduction was shown to be linked in the algal components of the Periphyton, and can be distinguished from heterotrophic sulfate uptake by bacteria and fungi. Functional indicies, analogous to species diversity indices, were developed as a result of the evaluation of the Periphyton community. Trophic Index values, Functional Trophic values, and the computation of a Viability Index are discussed. It is concluded that a combination of information from functional indicies and information on the fauna and flora of a system will provide a better understanding of the biological integrity of the system. (Davison-IPA)
W79-07516

IDENTIFICATION OF SUSPENDED SEDIMENT SOURCES BY MEANS OF MAGNETIC MEASUREMENTS: SOME PRELIMINARY RESULTS,
Liverpool Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W79-07533

CHEMICAL CHARACTERISTICS OF SMALL STREAMS NEAR HANEY IN SOUTHWESTERN BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 2K.
W79-07540

A FIELD STUDY OF THE RELATIONSHIP BETWEEN HEAVY METAL CONCENTRATIONS IN STREAM WATER AND SELECTED BENTHIC MACROINVERTEBRATE SPECIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W79-07570

VOLTAMMETRIC ION SELECTIVE ELECTRODE FOR THE DETERMINATION OF NITRATE,
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.
J. A. Cox, and G. R. Litwinski.
Analytical Chemistry, Vol. 51, p 554-556, April 1979. 3 fig, 16 ref. OWRT A-087-ILL(7).

Descriptors: *Nitrates, Chemical analysis, Anion exchange, Electrodes.

A sensor which uses an anion-exchange membrane to enclose a small volume electrolysis cell has been demonstrated to be suitable for nitrate determinations. The three-electrode cell includes a constrained mercury column indicator electrode; filter paper, which is impregnated with a 0.1 M KCl-0.01 M ZrOCl2 electrolyte, serves as the constraining barrier and as the spacer for the thin-layer electrolysis chamber. The anion-exchange membrane sheath permits transfer of nitrate from the sample into the electrolysis chamber by Donnan dialysis and excludes several species which would otherwise interfere. Controlled potential electrolysis at -1.25 V vs. Ag/AgCl provides the sensing current, the value of which is proportional to the sample concentration of nitrate. As a steady-state current is not developed with the present design, a defined current sampling time is used. Linear response over 3 orders-of-magnitude nitrate concentration is obtained. The detection limit using the current at 8 min. is 6.7 x 10-6M NO3-.
W79-07586

TESTING THE ENVIRONMENT FOR DISPERSED MUTAGENS: USE OF PLANT BIOCONCENTRATORS COUPLED WITH MICROBIAL MUTAGEN ASSAYS,
Massachusetts Univ., Amherst. Dept. of Botany.
W. S. Barnes, and E. J. Klekowski, Jr.
Environmental Health Perspectives, Vol. 27, p 61-67, December, 1978. 1 fig, 71 ref. OWRT B-053-MASS (4), 14-34-0001-6087.

Descriptors: Genetics, *Bioassay, *Ferns, Water pollution effects, Microbiology, Toxins, Plant pathology, Environmental effects, Carcinogens, Mutagens.

Mutagens dispersed in ecosystems are usually in low concentration and episodic in occurrence. The possibility of detecting such dispersed mutagens by utilizing indigenous bioconcentrator organisms coupled with a microbial mutagen assay may offer a useful screening protocol. Body extracts of these bioconcentrators can be suitably fractioned and tested for mutagens with various microbial mutagen assays. The fractions may be tested with a broad range of microbial assays covering numerous genetic end points as well as both with and without mammalian microsomal activation. This kind of environmental screening has an advantage over physicochemical techniques, in that sampling techniques are simpler and a wider chemical spectrum can be screened. There are problems inherent with testing a complex biological extract, however. If a reversion assay is used, the metabolite necessary for growth may be present. Toxins may be introduced, either concentrated from the environment in the same way as the mutagen, or produced by the concentrator itself. Finally, the concentrator may also produce an endogenous mutagen which will give spuriously active extracts. Methods for minimizing some of these difficulties are discussed. (Godfrey-Mass)
W79-07587

SCREENING AQUATIC ECOSYSTEMS FOR MUTAGENS WITH FERN BIOASSAYS,
Massachusetts Univ., Amherst. Dept. of Botany.
E. J. Klekowski, Jr.
Environmental Health Perspectives, Vol. 27, p 99-102, December, 1978. 11 ref. OWRT B-053-MASS (5), 14-34-0001-6087.

Descriptors: Genetics, *Bioassay, *Ferns, Water pollution effects, Toxins, Plant pathology, Environmental effects, Carcinogens, Mutagens, Osmunda regalis.

Recent research studies on the royal fern, Osmunda regalis, have documented a high incidence of post-zygotic mutational damage in a population growing in a river heavily polluted with paper processing wastes, whereas genetic studies of nearby populations in nonpolluted environments failed to detect mutational damage. Intensive genetic and cytogenetic studies of mutation in O. regalis indicate that natural populations of homosporous ferns may be useful in situ bioassay systems for monitoring the presence of mutagens in aquatic ecosystems. Since these organisms are long-lived perennials with an ontogenetic system which stores mutational damage, they can be manipulated to give an integrated estimate of mutational damage for specified blocks of time (in units of years). Thus, the fern bioassay may be an inexpensive means of detecting both chronic low dose and episodic high dose inputs of mutagenic pollutants into aquatic ecosystems. The fern mutagen bioassay is based upon the detection of numerous categories of post-zygotic mutation load in natural fern populations. The frequency of sporophytic and embryonic lethals, leaf or root mutations, auxotrophic gametophytic mutations as well as numerous phenotypic alterations of gametophyte morphology can be routinely detected and quantified. In addition, various two-break chromosome aberrations (paracentric inversions, reciprocal translocations and ring chromosomes) can be readily screened for in the spore mother cells of many homosporous ferns. (Godfrey-Mass)
W79-07588

CORRELATIONS BETWEEN DAPHNIA MAGNA AND FATHEAD MINNOW (PIMEPHALES PROMELAS) CHRONIC TOXICITY VALUES FOR SEVERAL CLASSES OF TEST SUBSTANCES,
Procter and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
A. W. Maki.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 411-421, 1979. 6 fig, 7 tab, 31 ref.

Descriptors: *Bioassay, *Detergents, *Surfactants, *Daphnia, *Minnows, Methodology, Toxicity, Trophic level, Metals, Polychlorinated biphenyls, Pesticide toxicity, Fecundity, Chlorinated hydrocarbon pesticides, Linear alkylate sulfonates, Standards, Water chemistry.

Chronic toxicity values were developed for Daphnia magna with six surfactants and a detergent builder, each selected on the basis of previously existing chronic fish test data. Predictive correlations were examined for testing end points between 21-d Daphnia chronics and 1-yr fish chronics to provide a short-term alternative chronic test species while developing toxicity data for an intermediate trophic level species. For the detergent materials tested, a strong correlation ($r=0.98$) exists between Daphnia and fish no-effect concentrations. A replacement term, NOEC (no observed effect concentration), is suggested to clarify interpretive ambiguities associated with the definition of the MATC (maximum acceptable toxicant concentration) value. Additional chronic toxicity data from the current literature for these two test species and several test substances representing metals, polychlorinated biphenyl isomers, and pesticide formulations were similarly compared. The relatively short life cycle and 21-d duration of the test, small water volumes, ease in handling, high fecundity, and good correlation of 21-d chronic data with chronic fish toxicity data make Daphnia chronic tests an attractive alternative to the conduct of longer term fish tests. (Deal-EIS)
W79-07603

DIELDRIN POLLUTION IN THE RIVER HOLME CATCHMENT, YORKSHIRE,
Manchester Univ. (England).
For primary bibliographic entry see Field 5C.
W79-07604

COMPARISON OF TOXINS IN THREE ISOLATES OF GONYAULAX TAMARENSIS (DINOPHYCEAE),
Rhode Island Univ., Kingston.
M. I. Alam, C. P. Hsu, and Y. Shimizu.
Journal of Phycology, Vol. 15, p 106-110, 1979. 3 fig, 1 tab, 19 ref.

Descriptors: *Toxicity, *Red Tide, *Dinoflagellates, *Gonyaulax, *Saxtoxin, Fish toxins, Poisons, Toxins, Chemical properties, Chemical analysis, Massachusetts, Cultures, Bioluminescence, Public

health, Falmouth, Orleans, Perch Pond, Mill Ponds.

Toxicity levels and profiles of three isolates of Gonyaulax tamarensis grown under the same conditions were compared. One isolate was collected from Ipswich, Massachusetts, during the massive red tide of 1972 along the New England coast. The other two isolates were obtained from Perch Pond (Falmouth, Massachusetts) and Mill Pond (Orleans, Massachusetts) located in the southwest and south of Cape Cod, Massachusetts, respectively. All the three cultures produced toxins with variation in their toxicity levels. Toxin contents were highest in the Ipswich isolate, followed in an order by Mill Pond and Perch Pond cultures. Morphological similarity existed between Ipswich and Mill Pond cells, whereas the Perch Pond cells possessed an additional ventral pore on the 1' epithecal plate. (Deal-EIS)
W79-07620

CHANGES IN PHYTOPLANKTON PHYSIOLOGY AND MORPHOLOGY IN RESPONSE TO DISSOLVED NUTRIENTS IN LOUGH NEAGH, N. IRELAND,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
C. E. Gibson, and R. J. Stevens.
Freshwater Biology, Vol. 9, p 105-109, 1979. 2 fig, 10 ref.

Descriptors: *Nutrients, *Metabolism, *Phytoplankton, *Tissue analysis, *Ireland, Cyanophyta, Phosphorus, Carbohydrates, Absorption, Cytological studies, Biochemistry, Chemical analysis, Phosphates.

Cell phosphorus and anthrone-reactive carbohydrate contents were measured over a 6-month period in the phytoplankton of Lough Neagh, N. Ireland. When all the soluble reactive phosphorus had disappeared from the water column, cell phosphorus contents began to decrease, reaching a minimum value of 0.4% ash-free dry weight. At this time, cell carbohydrate contents greatly increased and phosphorus sorption assays showed rapid uptake of orthophosphate. Following a presumed sediment phosphorus release, cell carbohydrate and phosphorus uptake rate decreased greatly and there was a subsequent increase in cell phosphorus content to 1.6% ash-free dry weight. As the cell phosphorus content declined, blue-green algal filaments became progressively shorter. On the basis of these responses it is likely that phosphorus limitation occurred over a 4-week period. (Deal-EIS)
W79-07621

PCBS AND ORGANOCHLORINE INSECTICIDES IN OYSTERS FROM COASTAL LAGOONS OF THE GULF OF MEXICO, MEXICO,
Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Ciencias del Mar y Limnologia.
For primary bibliographic entry see Field 5C.
W79-07630

ENVIRONMENTAL DISTURBANCE AND LIFE HISTORIES: PRINCIPLES AND EXAMPLES,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-07636

UPTAKE AND LOSS OF ZINC AND LEAD BY MUSSELS (MYTILUS EDULIS) AND RELATIONSHIPS WITH BODY WEIGHT AND REPRODUCTIVE CYCLE,
Australian Atomic Energy Commission Research Establishment, Lucas Heights. Environmental Biology Section.
For primary bibliographic entry see Field 5C.
W79-07646

SOURCES OF HEAVY METAL CONTAMINATION IN A RIVER-LAKE SYSTEM,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson.
Environmental Pollution, Vol. 18, p 131-138, 1979. 3 fig, 1 tab, 13 ref.

Descriptors: *Heavy metals, *Lakes, *Bottom sediments, *Wabigoon River(Canada), Mercury, Copper, Zinc, Cadmium, Iron, Path of pollutants, Sediment transport, Industrial wastes, Chemical wastes, Water chemistry, Chemical analysis.

Sediments of the Wabigoon River, Ontario, are polluted with Hg from an industrial source at Dryden. Downstream the river flows first through Clay Lake and then through Ball Lake. Hg, Cu, Zn, Cd and Fe concentrations in sediments of both lakes are correlated with organic C, but Hg content per unit concentration of organic C is higher, and increases more steeply with organic C, in Clay Lake than in Ball lake; in contrast, the Cu, Zn, Cd, and Fe concentrations per unit concentration of organic C are nearly the same in both lakes. These results substantiate the conclusion that the Hg originated at a point upstream from the lakes and tended to accumulate in Clay Lake on its way downstream, whereas the other metals were leached into the two lakes from diffuse sources in the surrounding terrain. Accumulation of river-borne organice pollutants in Clay Lake was also demonstrated. Application of the methods employed to the general problem of recognising and locating element anomalies is discussed. (Deal-EIS)
W79-07649

BACTERIAL STREAMER GROWTH IN A DISUSED PYRITE MINE,
University Coll. of North Wales, Bangor. Dept. of Biochemistry and Soil Science.
For primary bibliographic entry see Field 5C.
W79-07651

ZINC AND COPPER LEVELS IN BELFAST LOUGH,
Northern Ireland Polytechnic Jordanstown. School of Life Sciences.
For primary bibliographic entry see Field 5C.
W79-07657

APPLICATION OF A NEW BIOASSAY TO SCREEN THE TOXICITY OF POLYCHLORINATED BIPHENYLS ON BLUE-GREEN ALGAE,
Institute fuer Wasserforschung G.m.b.H., Dortmund, (Germany, F.R.).
N. Zullei, and G. Benecke.
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 786-792, 1978. 6 fig, 1 tab, 9 ref.

Descriptors: *Bioassay, *Polychlorinated biphenyls, *Pesticide toxicity, *Cyanophyta, *Dioxin, Algae, Toxicity, Laboratory tests, Analytical techniques, Chemical analysis, Chlorinated hydrocarbon pesticides, Chlorination, Chromatography.

A nes bioassay was applied testing the toxicity of several PCB's and tetrachlorodibenzo-p-dioxin against blue-green algae. The motility of the blue-green algae, as measured by a photoelectric cell, is used as the criterion of the toxicity. Biphenyls with a low degree of chlorination, TCDD, mono-, di-, and trichlorobiphenyls, inhibited the motility of Phormidium spec., while higher chlorinated biphenyls had no effect. (Deal-EIS)
W79-07658

INDUCTION OF BENZO (A) PYRENE MONOOXYGENASE IN FISH AND THE SALMONELLA TEST AS A TOOL FOR DETECTING MUTAGENIC/CARCINOGENIC XENOBIOTICS IN THE AQUATIC ENVIRONMENT,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Lab. for Marine Molecular Biology.
For primary bibliographic entry see Field 5C.
W79-07669

CHEMOSENSORY INDUCED BRADYCARDIA IN THE KELP CRAB, PUGETTIA PRODUCTA (RANDALL),
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W79-07673

IN VIVO EFFECT ON ATPASE IN CERTAIN TISSUES OF LABEO ROHITA AND SACCOBRANCHUS FOSSILIS, FOLLOWING CHRONIC CHLORDANE INTOXICATION,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5C.
W79-07674

DETECTION OF NAPHTHALENE BY THE BLUE CRAB, CALLINECTES SAPIDUS,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
W. H. Pearson, and B. L. Olla.
Estuaries, Vol. 2, No. 1, p 63-64, 1979. 1 tab, 7 ref.

Descriptors: *Animal behavior, *Crabs, *Chemoreceptors, *Naphthalene, *Callinectes, Organic compounds, Animal physiology, Crustaceans, Aromatic compounds, Toxicity, Pollutant identification, Oil, Oil spills.

Increases in the antennular flicking rate indicated that blue crabs, Callinectes sapidus, detected the petroleum hydrocarbon naphthalene. A low incidence of aggressive displays but no food searching or gathering followed naphthalene detection. The results suggest that the chemosensory abilities of decapod crustaceans cover a broader range of substances than previously supposed. (Deal-EIS)
W79-07676

INTERTIDAL ECOLOGY OF THE SEA SHORE NEAR TARAPUR ATOMIC POWER STATION,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5C.
W79-07677

A PORTABLE SUCTION DREDGE FOR QUANTITATIVE SAMPLING IN DIFFICULT SUBSTRATES,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
I. M. Brook.
Estuaries, Vol. 2, No. 1, p 53-56, 1979. 3 fig, 15 ref.

Descriptors: *Sampling, *Research equipment, *Bottom sampling, Sediments, On-site data collections, Dredging, Bottom sediments, Grasses, Benthic flora, Benthic fauna.

A lightweight, portable suction dredge has been used for five bottom types which usually present problems to benthic investigators. Water depth ranged from 0.25m to 5m. By use of a 0.25m2 quadrant or using the suction end as a probe with the depth of penetration limited by a collar, quantitative samples were taken in coarse sand, fine flocculent mud, dense turtle grass (Thalassia testudinum), sparse turtle grass over coralline rubble (Porites sp.) and carbonate rock with an overlay of shell rubble. The samples consisted of the material retained by a collecting bag attached to the suction dredge. None of the commonly used benthic sampling devices could obtain samples at all stations. (Deal-EIS)
W79-07678

A MATHEMATICAL MODEL FOR THE UPTAKE OF HEAVY METALS IN BENTHIC ALGAE,
Central Inst. for Industrial Research, Oslo (Norway).
For primary bibliographic entry see Field 5C.
W79-07680

DISTRIBUTION OF MIREX IN AN EXPERIMENTAL ESTUARINE ECOSYSTEM,

Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W79-07682

SOME ECOLOGICAL EFFECTS OF THE VENPET - VENOIL COLLISION,
Department of Industries, Sea Point (South Africa). Sea Fisheries Branch.
For primary bibliographic entry see Field 5C.
W79-07684

FACTORS INFLUENCING PH IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg (Sweden).
C. Brosset.
Water, Air and Soil Pollution, Vol. 11, No. 1, p 57-62, 1979. 2 fig, 3 tab, 1 ref.

Descriptors: *Acidic water, *Lakes, *Humic acids, *Hydrogen ion concentration, Humus, Acids, Organic matter, Chemical analysis, Water chemistry, Organic acids, Acid-base equilibrium, Analytical techniques.

Using an improved titration technique, Lee and Brosset have established the presence in a number of lake waters of an acid with (k sub a)=0.0003. It is shown that higher concentrations of this acid, which seems to correspond to a functional group of humus, may under certain conditions drastically contribute to the lowering of pH of lake water. In lake water containing no humic acid or humic acid in the concentration 0.0001 equiv/l to the minus first power, pH reduction has been calculated as a function of strong acid deposition. It was found that the ability of lake water to withstand a decrease in pH can be drastically reduced by the presence of higher concentrations of humic acid. (Deal-EIS)
W79-07687

DISTRIBUTION AND FRACTIONATION OF ARSENIC IN SELECTED FRESH WATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
P. M. Huang, and W. K. Liaw.
Internationale Revue den Gesamten Hydrobiologie, Vol. 63, No. 4, p 533-543, 1978. 2 fig, 5 tab, 23 ref.

Descriptors: *Sediments, *Lakes, *Lake sediments, *Arsenic, *Apatite, Colloids, Carbonates, Organic matter, Silicates, Particle size, Agricultural runoff, Erosion, Food chains, Water chemistry.

The distribution and nature of the As-bearing components of the sediments of selected fresh water lakes in Saskatchewan, Canada, were studied. The total As contents ranged from 2.7 to 13.2 ppm As and were found to be present in both colloidal and non-colloidal fractions of the lake sediments. The proportion of the As bound to carbonates, organic matter and sesquioxides accounted for 12 to 74% of the total As of the sediments. The remaining As was apparently associated with apatite and silicates. The data indicate that the bulk of As in the lake sediments resides in sequioxidic components and apatite. The release of As from the lake sediments would thus be affected by the stability of these As-bearing components in a series of particle size fractions. Furthermore, based on information on the geographical distribution of As in the lake sediments, land erosion and agricultural runoff appear to be contributing significantly to the As concentration in lake sediments. It is thus suggested that close attention should be paid to land management and soil conservation to prevent further enrichment of As in lake sediments and to curtail the subsequent As contamination of the food chain. (Deal-EIS)
W79-07689

UPTAKE FROM SEAWATER AND CLEARANCE OF P,P'-DDT BY MARINE PLANKTONIC CRUSTACEA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5C.
W79-07690

NUTRIENT BUDGET ANALYSIS FOR REND LAKE IN ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality, Section.
V. Kothandaraman, and R. L. Evans.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE3, Proceedings Paper 14616, p 547-556, June 1979. 3 fig, 4 tab, 11 ref, 1 append.

Descriptors: *Nutrients, *Lakes, *Streams, *Illinois, Algae, Streamflow, Water pollution, Water pollution sources, Sediments, Turbidity, Suspended solids, Phosphorus, Nitrates, Sodium, Potassium, Sampling, On-site investigations, Data processing, *Rend Lake(IL).

A new method for computing long-term average nutrient loads transported to the Rend Lake in southern Illinois by its tributaries was presented. The procedure was adopted from the Geological Survey's flow-duration curve method developed for determining the long-term average sediment loads transported by streams. The nitrogen and phosphorus loads exerted on Rend Lake were found to be excessive. The lake is of recent origin, and, despite the excessive nutrients input, algal counts in the lake are not of bloom proportion. Controlling phosphorus at the point sources will be a major step in arresting the accelerated aging of the lake. (Sims-ISWS)
W79-07748

REMOVING HYDROGEN SULFIDE WITH HYDROGEN PEROXIDE,
National Water Well Association, Wothington, OH.
For primary bibliographic entry see Field 5F.
W79-07762

INVESTIGATION OF THE ORION RESEARCH AMMONIA MONITOR,
Environmental Monitoring and Support Lab., Cincinnati, OH. Instrumentation Development Branch.
For primary bibliographic entry see Field 7B.
W79-07776

AN INDEX OF REFRACTORY ORGANICS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
T. B. Helfgott, F. L. Hart, and R. G. Bedard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 438, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-174, 1977. 131 p, 2 fig, 13 tab, 49 ref, 4 append.

Descriptors: *Refractivity, *Organic compounds, *Persistence, *Evaluation, *Industrial wastes, Biodegradation, Inhibitors, Waste water treatment, Biochemical oxygen demand, Activated sludge.

Laboratory techniques for, and interpretations of, a Refractory Index were developed to quantitatively assess the persistency of refractory organics. The Refractory Index is then used to evaluate 38 industrial, natural and combined organics. Index values close to 1.0 characterize readily biodegradation; index values close to 0 indicate refractory organics; negative index values indicate inhibitors. The index value coefficient of variation is 13%. A Biological Inhibition Value was developed and used to quantitatively assess those organics found to interfere with biochemical tests used. In some cases, confirmation of the Refractory Index interpretation was performed using a model activated sludge unit and by specific analysis. Correlations between oxygen demand tests and organic parameters (total organic carbon) are presented. Suggestions for required pretreatments of industrial waste waters before allowing discharge into municipal sewage treatment plants are included as an application of the Refractory Index criterion. (Small-FRC)
W79-07784

A REVISION OF EXISTING REGULATIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07883

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

DEVELOPMENT OF MINI-COMPUTER PROGRAMMING TO AID IN INTERPRETATION OF MASS SPECTRAL DATA,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
R. S. Scalan.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 13-1 - 13-68, 1979. 1 tab, 1 ref, 2 append. CC550-CT6-17.

Descriptors: *Texas, *Oil pollution, *Analytical techniques, *Pollutant identification, Baseline studies, Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Petroleum hydrocarbons, South Texas Outer Continental Shelf(STOCS).

A part of the integrated STOCS baseline study is the measurement and characterization of higher molecular weight hydrocarbons by the analytical techniques of combined gas chromatography and mass spectrometry. The combined analysis involves the use of a digital data acquisition and data synthesis system having a 'library' of mass spectra with which unknown mass spectra may be compared to assist in identification. The total system in use at this laboratory is a DuPont Model 21-491 GC-Mass Spectrometer (GC/MS) with a DuPont Model 21-094B data acquisition system. The library associated with this system contains 7054 mass spectra. (Sinha-OEIS)
W79-07924

DEVELOPMENT OF A CHELATING/CO-PRECIPITATION PROCEDURE FOR MATRIX-FREE ANALYSIS OF VARIOUS METALS IN ORGANISMS FROM THE SOUTH TEXAS OCS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Texas A and M Univ., College Station. Dept. of Oceanography.
B. J. Presley, and P. N. Boothe.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 14-1 - 14-29, 1979. 9 fig, 6 tab, 5 ref. CC550-CT6-17.

Descriptors: *Texas, *Spectrophotometry, *Metals, *Pollutant identification, Water pollution effects, Environmental effects, Heavy metals, Baseline studies, Cadmium, Nickel, Lead, *Outer Continental Shelf, Petroleum hydrocarbons, South Texas Outer Continental Shelf(STOCS).

A procedure is described using ammonium pyrrolidine dithiocarbamate (APDC) for the co-precipitation and preconcentration of trace metals in orga-

nism digests for subsequent determination using flameless atomic absorption spectrophotometry (AAS). The MLR coprex procedure described provides greatly increased sensitivity at the expense of increased variability. Therefore, it is a highly sensitive but semi-quantitative procedure for the study of certain trace metals in biological tissues. The method best measures Pb in all sample types, Ni in gill and Cd in liver tissues; and it is least effective in estimating Ni levels in muscle and liver. Application of the procedure to STOCS samples with previously undetectable metal levels generally confirms the low levels of Cd and Ni reported and indicates that Pb levels in these samples are only slightly below the detection limit. (Sinha-OEIS)
W79-07925

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME III - APPENDICES A-F.
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07927

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME IV - APPENDICES G - I,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07928

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME V - APPENDICES J - M,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07929

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME VI - APPENDICES N - S,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07930

AUTOMATED DETERMINATION OF TIN IN WATER,
Geological Survey, Denver, CO. Water Resources Div.
G. Pyen, and M. Fishman.
Atomic Absorption Newsletter, Vol. 18, No. 1, p 34-36, January-February 1979. 1 fig, 4 tab, 3 ref.

Descriptors: *Water analysis, *Bottom sediments, *Trace elements, *Chemical analysis, *Analytical techniques, Laboratory tests, *Atomic absorption spectrometer, *Tin, Sample preparation.

An automated laboratory flow-through procedure was developed to determine tin in water and streambed materials. Sample solutions for streambed materials are obtained by a standard U.S. Geological Survey extraction procedure. The interferences from most trace elements are eliminated by addition of EDTA. Sodium borohydride is added to the sample stream to form tin hydride which is then stripped from the solution with the aid of nitrogen and decomposed at 850C in a tube furnace that is in the optical path of an atomic absorption spectrometer. Twenty samples per hour can be analyzed. The detection limits are 1 microgram/L and 0.1 microgram/g for water samples and streambed materials, respectively. (Woodard-USGS)
W79-07950

ARSENIC CONTAMINATION OF GROUND WATER IN THE MARITIMES,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
D. J. Bottomley.
In: Hydrology Research Division, Annual Progress Reports and Short Notes, 1977-78. p 83-89, 1979. 3 tab, 2 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. HR 77-2.

Descriptors: *Arsenic compounds, *Water pollution, *Groundwater, *Sampling, *Laboratory tests, Analytical techniques, Spectroscopy, Well data, Well casings, Iron, Manganese, Alkalinity, Sulfates, Silica, Chlorides, Fluorides, Carbon, Organic compounds, Lead, Copper, Zinc, Nickel, Cadmium, Potassium, Strontium, Sodium, Nova Scotia(Canada), New Brunswick(Canada).

Three wells in Nova Scotia were sampled at the well head for major ion and trace element analysis; cation analysis; sulfate, chloride, silica, alkalinity and fluoride determinations; and organic carbon analysis. Atomic absorption spectroscopy was used to analyze As, Fe, Mn, Cu, Pb, Zn, Co, Ni, Cd, Ca, Mg, K, and Sr; sodium was analyzed by flame emmission. Manual arsine generation with sodium borohydride was used to analyze arsenic. It was found that the sampling methodology and pumping generation affected the concentrations of arsenic iron, and manganese in each well, and that in large diameter deep wells, a peristaltic pump was unsatisfactory for providing representative samples of arsenic, iron and manganese levels due to its inability to flush adequately the casing contaminants from the well. Concentrations of Cu, Pb, Zn, Co, and Ni were less than 5 micrograms/L, and Cd concentration was less than 1 microgram/L. Data obtained from Harvey, Waverley and Miller Lake samples indicate that most arsenic at Waverley is in the As3t state, and most of the inorganic arsenic at Harvey and Miller Lake is as As5t in the form of H2As04- or HAs042-. (Davison-IPA)
W79-07960

MICROBIOLOGICAL STUDIES,
Maryland Univ., College Park. Dept. of Microbiology.
R. R. Colwell, and M. R. Belas.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 9-14, 5 fig, 1 tab, 5 ref.

Descriptors: *Microorganisms, *Aquatic bacteria, *Coliforms, *Water pollution sources, *Potomac River, Analytical techniques, Data collections, Sampling, Monitoring, Water quality, Interstate Commission on the Potomac River Basin.

Data on the microbiology of the Potomac River were gathered from the Interstate Commission on the Potomac River Basin (ICPRB) for the years 1960 through 1975, and from the U. S. Army Corps of Engineers for the years 1950 through 1975 for statistical analysis to determine whether a decline in water quality has occurred as measured by microbiological indices. These data were entered and stored in the University of Maryland UNIVAC 1108 computer where multivariate analysis of variance (MANOVA), regression, and correlation coefficient tests were conducted at the five percent level of significance on the total data set and on selected subsets of the larger data file. Significant differences were observed in the downstream total coliform counts which most likely come from point source pollution entering the River during its down stream flow. Large increases in bacterial numbers were observed at Williamsport, Maryland, as the flow moved downstream. No detectable year to year change in water quality downstream was observed. Differences in yearly grand means of the total coliform counts could be distinguished with a significant increase in bacterial numbers for 1968. Because ICPRB data were limited no conclusions could be made regarding improvement or decline in water quality based on microbiological parameters. From the U. S. Army Corps of Engineers data, a general trend was noted toward increasing number of coliform bacteria at Great Falls during the 1950 to 1977 period. It is concluded that water quality is decreasing in the Potomac and that measuring and sampling techniques are inadequate for detecting water quality changes. (Davison-IPA)
W79-07963

PHYTOPLANKTON,
Environmental Monitoring and Support Lab., Cincinnati, OH.
C. I. Weber, W. T. Mason, and V. J. Rasin.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 15-24, 10 fig, 3 tab, 19 ref.

Descriptors: *Phytoplankton, *Data collections, *Data storage and retrieval, *Potomac River, Eutrophication, Nutrients, Sampling, Analytical techniques, Zooplankton, Water pollution sources, Water pollution, Water quality.

Systematic sampling of the phytoplankton was carried out at four stations in the Potomac River Basin by the National Water Quality Network from 1958 through 1967. Samples collected on about the first and 15th of each month had volume of 3.6 liters, and were preserved with 36 mg/liter MERTHIOLATE (Copyright). Three types of analyses were performed on each sample at the central laboratory in Cincinnati: (1) Sedgwick-Rafter phytoplankton count, (2) a diatom species count, and (3) a zooplankton count. The basic data on the species and abundance of the plankton are currently stored in the files of the Aquatic Biology section, Environmental Monitoring and Support Laboratory, EPA, Cincinnati, Ohio, and the summary data were coded, machined and entered on line into the Storet system. The total annual mean phytoplankton counts increased with distance downstream from Williamsport, the uppermost station on the river. This indicated favorable growth conditions, such as higher concentrations of dissolved nutrients. The percentage of the total counts exceeding 10,000 units/ml was 2% at Williamsport, 18% at Great Falls, and 37% at Washington. The lower Potomac would be considered highly eutrophic on the basis of total counts. The diversity of the phytoplankton measured as numbers of genera, increased with distance downstream from Williamsport. The dominant genera, increased with distance downstream from Williamsport. The dominant genera indicated significant levels of nutrient enrichment. The plankton genera in the Potomac River are tabulated. It is concluded that the total counts and taxonomic composition of the River are characteristic of surface waters with high concentrations nutrients occurring in waste treatment plant effluents. (Davison-IPA)
W79-07964

ROOTED AQUATIC PLANTS,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
L. Keup, and D. B. Hicks.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 25-28, 1 fig, 3 tab, 4 ref.

Descriptors: *Rooted aquatic plants, *Nutrients, *Nitrogen, *Phosphorus, Eutrophication, Sampling, Standing crop, Potomac River, Monocacy River, Antietam Creek, Conococheague River, South Branch Potomac River, Cacapon River, Shenandoah River.

A study was conducted of the aquatic plants in the upper Potomac River Basin by the EPA Division of Field Investigations to estimate the quantity of phosphorus (P) and organic nitrogen (N) accumulated in rooted plant growth, and to assess the significance of those stored nutrients on the nutrient budget of the River Basin. The study area extended 220 miles upstream from Great Falls to

the confluence of the Savage River, and included the following tributaries: Monocacy River, Antietam Creek, Conococheague Creek, South Branch Potomac River, Cacapon River, and Shenandoah River. Study results are reported as estimated tons of plants containing P and N in terms of pounds for the upper Potomac River, Antietam Creek, and Conococheague Creek. The Monocacy, South Branch Potomac, Shenandoah, and Cacapon Rivers did not contain sufficient growths of aquatic plants from which standing crop estimates could be made. It is concluded that the rooted aquatic plants in the upper Potomac basin are not a significant factor in the nutrient budget of the lower Potomac River, because the quantities of P and N contained are equivalent to about 40% of the P and N in the waste waters discharged to the upper Potomac River in a single day. (Davison-IPA)
W79-07965

BIOLOGICAL INDICES IN WATER QUALITY ASSESSMENT,
Versar, Inc., Springfield, VA.
J. R. Freed, and M. W. Slimat.
Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 76-79, 16 ref.

Descriptors: *Bioindicators, *Water pollution effects, *Water quality, *Chemical analysis, Water analsis, Ecology, Ecosystems, Evaluation, Indicators, Pollutant identification, Federal Water Pollution Control Act Amendments of 1972, Mattawoman Creek(Maryland).

The settlement of litigation between environmental groups and the EPA over whether the assessment of water quality should include biological indices as well as chemical indices required the EPA to develop knowledge on biological means to measure water quality. Advantages of biological assessment methods include: (1) they complement the more frequently used chemical methods; (2) they measure the response of the biotic community; (3) they measure the results of pollution, and therefore are more indicative of the consequences of pollution; and (4) because the biotic community represents 'the results of a summation of the prevailing conditions,' the effects of intermittent or single discharges of pollution can be measured. Various biological indices for assessing water quality are examined. When a study must be confined to a synoptic component of the condition of the whole ecosystem, it is felt that benthic invertebrates are most likely to be the most useful group to be studied. The saprobien system recognizes three major zones indicative of organic pollution. The indicator organism approach, a derivative of the saprobiensystem, uses organisms classified according to their ability to tolerate organic pollution. Reference station methods compare the characteristcs of clean water habitats with polluted habitats. Diversity indices, some of the most widely used tools, characterize communities by the number of species present. An example of the use of biological indices to assess long-term water quality after an oil spill in a tributary of the Potomac River is given. (Davison-IPA)
W79-07973

EFFLUENT TOXICITY TESTING,
Environmental Protection Agency, Wheeling, WV.
H. R. Preston.
Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 84-89, 2 fig, 1 tab, 4 ref.

Descriptors: *Pollutant identification, *Effluents, *Toxicity, *Water pollution, *Industrial wastes, *Municipal wastes, Analytical techniques, Water analysis, Water quality, Technology, Equipment, Minnows, Liquid wastes, Construction materials, Laboratory tests.

The basic needs and requirements for conducting valid toxicity tests on municipal and industrial effluents are discussed. A mobile laboratory developed by the aquatic biologists of EPA Region III is capable of performing static and continuous flow toxicity tests near effluent discharge points. The mobile laboratory is designed to meet the specifications required by accepted methodology as identified in 'Methods for Acute Toxicity Tests with Fish, Macroinvertebrates and Amphibians,' EPA-660/3-75-009, April 1975. Effluent, pumped to the laboratory, is proportionally mixed with the receiving water and delivered to test containers. Toxicity tests are conducted on different effluent concentrations for a standard 96-hour period; each exposure and controls are tested in duplicate. The fathead minnow is used as the test organism, because it is indigenous to most of the U.S., is easy to maintain and reproduce in the laboratory, and is commercially available. Testing requirements, construction materials, and equipment are discussed. The testing procedure is described. The results of toxicity tests conducted on 11 different discharges from five industrial types show all but two produced some level of measurable acute toxicity. Schematic diagrams illustrate the laboratory floor plan and the laboratory interior. (Davison-IPA)
W79-07974

BIOMONITORING OF PULP AND PAPER EFFLUENTS,
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella, G. Katz, and G. Shoemaker.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 137-142, 2 fig, 2 tab.

Descriptors: *Pollution abatement, *Water quality, *Bioindicators, *Aquatic invertebrates, *Municipal wastes, *Industrial wastes, *Pulp wastes, Water quality control, North Branch Potomac River(Maryland), Luke(Maryland), Westvaco Corporation, Biochemical oxygen demand, Suspended solids.

The biological water quality investigation of effluent from the Westvaco Corporation mill in Luke, Maryland, relies on the distribution and community structure parameters of resident macroinvertebrates of the North Branch Potomac River to indicate changes in water quality. Data were collected from 12 mainstream stations and three tributary stations over 18 years from 1959 to 1976. A regional waste treatment facility constructed by the Upper Potomac River Commission (UPRC) 1960 treats mill effluents and municipal wastes from three towns. Until recently the mill discharges included wastes treated by the UPRC facility and unsegregated process streams and discharges which went directly from the mill to the river. The main waste stream components of BOD5 and total suspended solids (TSS) for direct mill discharges, UPRC treatment plant discharges, and total discharges to the river are tabulated for the years of the monitoring program. Major reductions have occurred in the most recent five-year period, coinciding with the steady improvement in the macroinvertebrate community in the North Branch Potomac River. Immediately upstream from the mill site North Branch water quality is still in extremely poor condition. Water quality rapidly improves from the mill to mile 45, and for the last 20 miles of this study the biological communities indicate good to excellent water quality. Faunal distribution has increased 44% in the critical zone between mile -1.8 to mile 29 since the 1959 base line survey. (Davison-IPA)
W79-07983

WATER QUALITY EFFORTS BY CHEMICAL INDUSTRIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
A. C. Hendricks.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 143-146, 1 fig, 4 tab, 8 ref.

Descriptors: *Pollution abatement, *Industrial wastes, *Chemical wastes, *Water quality control, Water pollution treatment, Pollutant identification, Water pollution sources, Potomac River basin, Avtex Fiber Plant(Front Royal VA).

The major chemical industries in the Potomac River basin have installed extensive treatment facilities to improve quality of their effluents. One plant, the Avtex Fiber Plant at Front Royal, Virginia, installed waste treatment facilities with primary and secondary treatments at the plant in 1974. The previous owner of the plant, FMC, initiated a bottom fauna and fish bioassay program in 1972 which is being continued by Avtex. The data from those programs indicates a reduction in effluent toxicity, particularly after the installation of the secondary treatment facility. Chemical parameters Avtex is required to monitor by the state of Virginia include: BOD5, zinc and total suspended solids. Over the past 10 years the water quality in the Potomac River basin has improved. It is concluded that the improvement appears to be due to the water quality enhancement efforts of the industries and municipalities of the basin. (Davison-IPA)
W79-07984

THE DISTRIBUTION OF TRACE METALS IN THE WILDERNESS LAKES,
National Physical Research Lab., Pretoria (South Africa). Applied Spectroscopy Div.
R. J. Watling.
Water S. A., Vol. 5, No. 1, p 1-13, January 1979. 9 fig, 5 tab, 17 ref.

Descriptors: *Water analysis, *Sediments, *Cores, *Sampling, *Metals, *Copper, Lead, Zinc, Iron, Manganese, Cobalt, Cadmium, Nickel, Mercury, Sodium, Potassium, Calcium, Strontium, Aluminum, Chromium, Water pollution sources, Trace metals, Wilderness Lakes(South Africa).

Surface water, sediment, and sediment core samples were taken in the Wilderness Lakes area on the coast between Cape Town and Port Elizabeth, South Africa, to provide information on the trace metals present in the lakes, and to establish trends in metal build-up. Concentrations of the following nine trace metals found in the surface waters are tabulated: Cu, Pb, Zn, Fe, Mn, Co, Ni, Cd, and Hg. Generally little overall variation for Cu, Pb, Zn, Ni, Co, and Cd was found. The relatively high levels of lead found near the northern and eastern ends of Swartulei Lake near the town of Sedgefield are a possible result of urban pollution. Results for metal concentrations in the Wilderness Lakes sediments are tabulated for: Cu, Pb, Zn, Fe, Mn, Co, Ni, Cd, Na, K, Ca, Mg, Sr, Al, and Cr. Copper level in the sediments was low, but occasional isolated anomalies occur, such as that at the eastern end of Langvlei Lake which was attributed to pollution from adjacent road work. Lead and zinc distribution was elevated but uniform, and also associated with the road work in the upper reaches of the lagoon. Core sediment samples were analyzed statistically to obtain interelemental relationships. In addition to confirming the results obtained for the surface sediment samples, evidence of pollution from motor fuel was noted in the marked increase of lead in the top centimeters of some cores. Only cores from Sedgefield, Island Lake Yacht Club, and Island Lake Holiday Camp showed evidence of pollution by man. Correlation frequency diagrams indicate the area is relatively free of pollution with respect to metals. (Davison-IPA)
W79-07994

5B. Sources Of Pollution

REPORT ON TOXIC/HAZARDOUS ORGANIC COMPOUNDS IN THE WABASH RIVER BASIN,
Environmental Protection Agency, Chicago, IL. Central District Office.
D. H. Stoltenberg.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 548, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-905/3-77-001, July 1977. 112 p, 3 fig, 16 tab, 16 ref, 5 append.

Descriptors: *Waste pollution sources, *Hazards, *Poisons, *Toxicity, *Organic loading, *Organic wastes, Municipal wastes, Industrial wastes, Sludge, Sediments, Rivers, Streams, Water supply, Wabash River Basin.

All available ambient and point source organics data on the Wabash River Basin are gathered from previous studies, condensed, and presented. Information from the EPA, Indiana State Board of Health, and Illinois EPA includes industrial and municipal point source data, ambient river and stream data, fish data, carbon filter data, sludge and sediment data, and public water supply data. Major and minor municipal, industrial, and Federal known or potential dischargers of toxic/hazardous organics are listed. For each compound from each source data are presented in terms of micrograms/l and lb/da. All 304 sources were analyzed for about 78 compounds. These compounds are ranked in decreasing order of magnitude from the sources tested. Eleven conclusions/recommendations resulting from this Phase I investigation are presented. Excerpts from previous reports are provided in the appendices. (Davison-IPA)
W79-07511

BUOYANT JET DISCHARGE INTO FINITE AMBIENT WATERS,
Indian Inst. of Tech., Madras. Ocean Engineering Centre.
I. V. Muralikrishna, and K. V. N. Sarma.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14586, p 517-532, May 1979. 20 fig, 2 tab, 6 ref, 2 append.

Descriptors: *Heated water, *Thermal pollution, *Dispersion, *Jets, Discharge(Water), Cooling water, Powerplants, Buoyancy, Density, Entrainment, Mixing, Heat, Temperature, Water temperature, Distribution patterns, Laboratory tests, Correlation analysis.

The paper presented the results of an experimental study regarding the effect of the lateral dimension of the receiving water on the spreading, mixing, and temperature decay of a horizontal buoyant surface jet. The widths of the ambient water in the experiments were 240, 120, 90, and 60 times the diameter of the jet nozzle. Based on the experimental data, correlations were carried out, and empirical equations for prediction of jet width, thickness in vertical direction, and longitudinal temperature decay were obtained. The available data of earlier investigators were included to obtain generalized equations for the spreading and temperature decay. Similarity of temperature profiles in the lateral and vertical directions was observed. The longitudinal temperature decay was found to vary inversely with distance in the flow direction and 1/4th power of the densimetric Froude number. (Sims-ISWS)
W79-07532

IDENTIFICATION OF SUSPENDED SEDIMENT SOURCES BY MEANS OF MAGNETIC MEASUREMENTS: SOME PRELIMINARY RESULTS,
Liverpool Univ. (England). Dept. of Geography.
F. Oldfield, T. A. Rummery, R. Thompson, and D. E. Walling.
Water Resources Research, Vol. 15, No. 2, p 211-218, April 1979. 7 fig, 2 tab, 22 ref.

Descriptors: *Suspended solids, *Sediments, *Magnetic studies, Water pollution sources, Soil erosion, Soils, Watersheds(Basins), Streams, Rivers, Rainfall, Runoff, On-site investigations, Erosion, Sedimentation, *Exeter(United Kingdom).

Rapid, nondestructive magnetic measurements of initial low-field susceptibility (Chi), saturation isothermal remanent magnetization (IRM sub sat), and coercivity of IRM provide a means of identifying the source of suspended sediments in rivers. Preliminary results derived from the application of these measurements both to suspended sediment and to potential sources within the instrumented catchment of the Jackmoor Brook near Exeter, United Kingdom, demonstrated the value of this approach in an area of Permian sandstone bedrock where the contrast in magnetic properties between parent material and topsoil is easily characterized. High flows were shown to be associated with suspended sediment, the magnetic properties of which are indistinguishable from those of the cultivated soils of the catchment. (Sims-ISWS)
W79-07533

CHEMICAL CHARACTERISTICS OF SMALL STREAMS NEAR HANEY IN SOUTHWESTERN BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Faculty of Forestry.
For primary bibliographic entry see Field 2K.
W79-07540

ARSENIC IN STREAMS, STREAM SEDIMENTS, AND GROUND WATER, FAIRBANKS AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
F. H. Wilson, and D. B. Hawkins.
Environmental Geology, Vol. 2, No. 4, p 195-202, July-August, 1978. 4 fig, 13 ref. OWRT A-050-ALAS (1).

Descriptors: *Arsenic compounds, *Alaska, *Water pollution, Mine wastes, Spoil banks, Dredging, Streams, Suspended load, Sediment, Bed load, Water wells, Well casings, Surface water, Groundwater, Mining, Mills, Weathering, Geochemistry.

The arsenic content of streams and ground water in the Pedro Dome-Cleary Summit area, 30 kilometers north of Fairbanks, Alaska, was evaluated. Arsenic is associated with gold mineralization in this area and is believed to reach the surface and ground waters through weathering of arsenic-containing rocks in mine tailings. Wells drilled through dredge tailings without casings cemented in place were found to have high arsenic concentrations. The mobility of arsenic in surface and ground waters is closely tied to the behavior of iron in these waters. Because of the mobility of arsenic and the numerous sources of arsenic available in the Fairbanks area, public and private water supplies in the mineralized zone should be examined for arsenic contamination. In addition, treatment techniques suitable for home use to remove arsenic and other metal pollutants should be developed. (Purdin-NWWA)
W79-07563

A FIELD STUDY OF THE RELATIONSHIP BETWEEN HEAVY METAL CONCENTRATIONS IN STREAM WATER AND SELECTED BENTHIC MACROINVERTEBRATE SPECIES,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
R. P. Maas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 284, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, 1978. 74 p, 13 fig, 13 tab. OWRT A-095-NC (1), 14-34-0001-9035.

Descriptors: *Heavy metals, Benthic macroinvertebrates, Stream monitoring, *Bioindicators, Streams, Cadmium, Chromium, Zinc.

The correlation between heavy metal concentrations in stream water and selected benthic macroinvertebrate species from stations on the Neuse River, NC watershed was studied to determine the utility of benthic macroinvertebrates as monitors of short and long term stream metal conditions. Cadmium, chromium and zinc were determined in both water and test organisms by graphite furnace atomic adsorption spectrophotometry (GFAAS). The GFAAS method proved satisfactory for metal quantification in all water and test organism samples. Relatively good linear correlations between water and test organism metal concentrations were observed for most cases. The highest correlations were observed for chromium while zinc exhibited the poorest linear correlations due to the substantial levels of this metal found naturally even in organisms existing in relatively zinc free waters. Results of laboratory exposure and daily field sampling experiments showed that metal uptake to equilibrium levels generally occurred within one day of exposure, while loss of metal to equilibrium levels required two to six days following cessation of exposure. The evaluation of the response of the test organisms to their surrounding aqueous metal concentrations was limited by the relatively low and narrow metal concentration range observed at most of the sampling stations. (Kiger-North Carolina)
W79-07570

MICROBIOLOGICAL STUDIES ON THE NITROGEN CYCLE IN AQUATIC ENVIRONMENTS - V NITROGEN METABOLISM IN THE GOLDFISH CULTURING POND,
Kyoto Univ., (Japan). Research Inst. for Food Science.
A. Kawai, and M. Sugiyama.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 1, p 61-65, 1979. 9 fig, 2 tab, 4 ref.

Descriptors: *Nitrogen cycle, *Metabolism, Aquiculture, Fish hatchery, *Goldfish, Nitrogen, Nitrates, Nitrites, Tracers, Radioactivity techniques, Trophic level, Ammonium compounds, Zooplankton, Microbial degradation, Denitrification, Water chemistry, Phytoplankton, Bottom sediments, Aquatic bacteria.

By the use of the 15N tracer technique, nitrogen metabolism was studied in the model system of a goldfish culturing pond. A large part of the 15N labeled ammonium nitrogen metabolized was incorporated into the organisms of the primary trophic level in the early stages of the experiment, then transformed into dissolved organic nitrogen either in the excretion of the organisms or in the decomposition process of their dead bodies. On the other side, only a small amount of this ammonium nitrogen was incorporated into the organisms of the higher trophic level, zooplankton and fish. Ammonium nitrogen in the water was oxidized to nitrate nitrogen via nitrites; a considerable part of this nitrite nitrogen was transformed to gaseous nitrogen in the process of bacterial denitrification. A large amount of ammonium nitrogen was also transfered into the bottom mud through various metabolic pathways. (See also W78-12867) (Deal-EIS)
W79-07592

EXPERIMENTAL DEGRADATION OF CRUDE OIL BY MARINE BACTERIA,
Kobe Univ. of Mercantile Marine (Japan). Research Inst. of Marine Cargo Transportation.
S. Nagata, G. Kondo, and T. Asano.
Journal of the Oceanographical Society of Japan, Vol. 34, p 105-107, 1978. 1 fig, 3 tab, 6 ref.

Descriptors: *Microbial degradation, *Marine bacteria, *Oil, *Achromobacter, *Staphylococcus, *Acinetobacter, *Corynebacterium, *Listeria, *Aeromonas, *Flavobacterium, *Chromobacterium, *Micrococcus, *Arthrobacter, Biodegradation, Aromatic compounds, Organic compounds, Bacteria, Industrial wastes, Oil pollution, Growth rates, Cultures.

The ability to biodegrade crude oil was examined for ten strains of marine bacteria. With regard to their degradation ability for n-alkanes the microorganisms tested could be divided into four groups. The four groups, in increasing order of biodegradation ability, were: (A) Achromobacter sp., Staphylococcus sp.; (B) Acinetobacter sp., Corynebacterium sp., Listeria sp.; (C) Aeromonas sp., Flavobacterium sp., Chromobacterium sp.; and, (D) Micrococcus sp. and Arthrobacter sp. The same result was not observed for microbial degradation of aromatic hydrocarbons obtained by the UV measurements. (Deal-EIS)
W79-07594

UPTAKE OF METHYLAMINE (AN AMMONIUM ANALOGUE) BY MACROCYSTIS PYRIFERA (PHAEOPHYTA),
California Inst., of Tech., Corona Del Mar. Kerckhoff Marine Lab.
P. A. Wheeler.
Journal of Phycology, Vol. 15, p 12-17, 1979. 3 fig, 5 tab, 18 ref.

Descriptors: *Absorption, *Ammonium compounds, *Phaeophyta, *Tissue analysis, *Methylamine, Nitrogen compounds, Plant physiology, Plant tissues, Radioactivity techniques, Tracers, Carbon radioisotopes, Inhibition, Chemical analysis, Marine algae, Water temperature, Hydrogen ion concentration, Enzymes, Nutrients.

The ammonium analogue, methylamine, is taken up rapidly from dilute solution by Macrocystis pyrifera. 14C-methylamine was used to characterize the transport system, with respect to dependence on external concentration, temperature, pH and substrate specificity. The results suggest that methylamine enters the algal tissue via a specific mediated transport system. Uptake of methylamine showed no consistent relation to the N content of the plant tissue, but was highly dependent on the portion of plant sampled and severely affected by cutting the tissue. The strong inhibition of methylamine uptake by ammonium and lesser inhibition by other alkylamines suggests that the uptake functions as an 'ammonium permease'. Uptake of 14C-methylamine can be used as a highly sensitive measure of NH4+ uptake activity and should be a useful tool for studying NH4+ uptake in the laboratory and field. (Deal-EIS)
W79-07600

EXPANSION OF A CENTRAL CALIFORNIA KELP FOREST FOLLOWING THE MASS MORTALITY OF SEA URCHINS,
California Univ., Santa Cruz. Center for Coastal Marine Studies.
K. S. Pearse, and A. H. Hines.
Marine Biology, Vol. 51, p 83-91, 1979. 6 fig, 1 tab, 27 ref.

Descriptors: *Mortality, *Phaeophyta, *Competition, *Kelps, *Sea urchins, *Diversity, Dominant organisms, Animal pathology, Plant groupings, Plant growth, Plant populations, Succession, Marine algae, Rhodophyta, Marine benthos.

The mass mortality by disease of a localized population of sea urchins, Strongylocentrotus, on the seaward side of a kelp forest was followed by the rapid seward expansion of 4 species of brown algae, Macrocystis pyrifera, Laminaria dentigera, Pterygophora california, and to a lesser extent, Nereocystis leutkeana. One other brown alga, Cystoseira osmundacea, failed to become established in the newly available area. Competition among M. pyrifera, L. dentigera, P. californica, and N. leutkeana apparently was severe, and within 1 year after the demise of the sea urchin, M. pyrifera formed a dense, nearly monospecific stand. Experimental removal of M. pyrifera demonstrated that the canopy of these plants limited light penetration to levels below that necessary for the growth and survival of other brown and red algae. (Deal-EIS)
W79-07601

METAL CONTENTS OF THE TWO MARINE ALGAE FOUND ON IRON ORE TAILINGS,
Chinese Univ. of Hong Kong. Dept. of Biology.
M. H. Wong, K. Y. Chan, S. H. Kwan, and C. F. Mo.
Marine Pollution Bulletin, Vol. 10, p 56-59, 1979. 2 fig, 2 tab, 20 ref.

Descriptors: *Marine algae, *Heavy metals, *Mine wastes, *Chaetomorpha, *Enteromorpha, *Tissue analysis, Iron, Manganese, Lead, Zinc, Nutrients, Adaptation, Chemical analysis, Calcium, Potassium, Magnesium, Sodium, Cytological studies.

The two marine algae, Chaetomorpha brychagona and Enteromorpha crinita are found abundantly on the iron ore tailings of Tolo Harbour, Hong Kong, with a rather high level of various metals. Tissue analysis of the algae revealed that the contents of heavy metals (Fe, Mn, Pb and Zn) were higher than in the population collected from two uncontaminated sites faraway from the tailings. It was suggested that the algae were able to adapt to such a harsh environment with a comparatively high level of trace elements and the lack of basic nutrients. However, further studies are needed before any conclusion can be drawn. The delicate situation of the land-locked sea, Tolo Harbour, where the tailings and future heavy industrial site are situated, should not be overlooked. (Deal-EIS)
W79-07609

RELATION BETWEEN TOXICITY AND ACCUMULATION OF VARIOUS CHLOROPHENOLS IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture.
K. Kobayashi, H. Akitake, and K. Manabe.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 2, p 173-175, 1979. 3 fig, 1 tab, 7 ref.

Descriptors: *Phenols, *Toxicity, *Bioaccumulation, *Tissue analysis, *Chlorophenols, *Goldfish, *Carassius, Chlorine, Chlorination, Chemical properties, Lethal limit, Mortality, Fish physiology, Animal metabolism, Organic compounds, Chemical analysis.

A study was made of the relation between the toxicity and the accumulation in goldfish, Carassius auratus, of seven chlorophenols: 2-chlorophenol; 4-chlorophenol; 2, 4-dichlorophenol; 2, 4, 5-trichlorophenol; 2, 4, 6-trichlorophenol; 2, 3, 4, 6-tetrachlorophenol; and pentachlorophenol. An increase of the Cl-atom number in the chlorophenols caused an abrupt increase in toxicity to the fish and also increased the concentration ratios in their media to lethal or sublethal concentrations. The results suggest that the increase of toxicity from polychlorinated phenols is mostly due to their accumulation in the fish. Their concentrations in the fish eventually achieve a certain lethal level (roughly 100-200 micro/g body weight), although the chemical form, locality, and physiological activity of the chlorophenols in the tissues of the fish must also be involved. (Deal-EIS)
W79-07614

TRENDS IN APPLIED PHYCOLOGY WITH A LITERATURE REVIEW: SEAWEED FARMING ON AN INDUSTRIAL SITE,
Department of Marine Botany, Goteborg (Sweden).
G. Michanek.
Botanica Marina, Vol. 21, p 469-475, 1978. 7 ref.

Descriptors: *Marine algae, *Kelps, *Phycology, *Seaweed, Marine plants, Foods, Phytoplankton, Biomass, Phaeophyta, Aquiculture, Plant physiology, Algae, Human diseases, Sewage.

Some aspects of trends in seaweed utilization are given as an introduction to a list of papers published during the last five years, pertinent to seaweed cultivation. Ocean farming projects of billion dollar magnitude are planned for energy recovery, to take over when natural gas sources are exhausted. Greenhouse cultivation methods are being elaborated to substitute for harvesting of natural resources and to give raw material of controlled chemical composition. Nutrient resources which have up to now been wasted through sewage can be taken advantage of, and their energy level raised, by plankton assimilation. In developing countries, harvesting on sea shores is replaced by culturing on ropes and rafts. The use of algae as human food is declining except for in Japan, China and Korea, and priceless know-how is rapidly being lost. It is observed that one trend is missing: the possibility of using seaweed as a remedy for diseases with wide distribution and prevalence such as goitre and intestinal worm infections. (Deal-EIS)
W79-07619

CHANGES IN PHYTOPLANKTON PHYSIOLOGY AND MORPHOLOGY IN RESPONSE TO DISSOLVED NUTRIENTS IN LOUGH NEAGH, N. IRELAND,
Northern Ireland Dept. of Agriculture, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5A.
W79-07621

TOXICITY AND BIOACCUMULATION OF HEXACHLOROCYLOPENTADIENE HEXACHLORONORBORNADIENE AND HEPTACHLORONORBORNENE IN LARVAL AND EARLY JUVENILE FATHEAD MINNOWS, PIMEPHALES PROMELAS,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5C.
W79-07622

BIOCONCENTRATION OF CHLORDANE BY THE GREEN ALGA SCENEDESMUS QUADRICAUDA,
Toronto Univ. (Ontario). Faculty of Forestry.
For primary bibliographic entry see Field 5C.
W79-07625

VESSEL-RELATED CONTAMINATION OF SOUTHERN CALIFORNIA HARBOURS BY COPPER AND OTHER METALS,
Southern California Coastal Water Research Project El Segundo.
For primary bibliographic entry see Field 5C.
W79-07628

CALANOID COPEPOD EGGS IN SEA-BOTTOM MUDS. IV. EFFECTS OF SOME ENVIRONMENTAL FACTORS ON THE HATCHING OF RESTING EGGS,
Hiroshima Univ. (Japan). Faculty of Fisheries and Animal Husbandry.
S. Uye, S. Kasahara, and T. Onbe.
Marine Biology, Vol. 51, p 151-156, 1979. 1 fig, 6 tab, 21 ref.

Descriptors: *Copepods, *Oxygen, *Salinity, *Water temperature, *Hatching, *Calanopia, *Labidocera, *Acartia, *Centropages, Bottom sediments, Reproduction, Oxygen requirements, Neritic, Japan, Benthic fauna, Plankton, Animal physiology, Seasonal.

The hatching of resting eggs of 6 species of marine calanoid copepods, recovered from neritic sea-bottom muds in the central part of the Inland Sea of Japan was examined under various environmental conditions (temperature, salinity, oxygen concentration, illumination and presence of bottom mud). Temperature and oxygen concentration were found to be important factors affecting hatching. The respective ranges of temperature in which the eggs of each species hatched correspond closely to the range of temperature at which the planktonic population of that species was observed in the natural environment. Extremely low oxygen concentrations in the water completely inhibited hatching in all species. A wide range of salinity and the presence of absence of illumination did not prevent hatching. (Deal-EIS)
W79-07642

SOURCES OF HEAVY METAL CONTAMINATION IN A RIVER-LAKE SYSTEM,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5A.
W79-07649

ADAPTATIONS TO SULFIDE IN THE MEIOFAUNA OF THE SULFIDE SYSTEM. I. 35S-SULFIDE ACCUMULATION AND THE PRESENCE OF A SULFIDE DETOXIFICATION SYSTEM,
North Carolina, Univ. at Chapel Hill. Dept. of Zoology.
E. N. Powell, M. A. Crenshaw, and R. M. Rieger.
Journal of Experimental Marine Biology and Ecology, Vol. 37, p 57-76, 1979. 4 fig, 2 tab, 58 ref.

Descriptors: *Sulfides, *Tracers, *Hydrogen sulfide, *Tissue analysis, *Bioaccumulation, *Turbellarians, *Gastrotrichs, *Proseriates, *Myopea, *So-

lenofilomorpha, *Pseudohaplogonaria, *Archiloa, Radioisotopes, Radiochemical analysis, Sulfur, Animal physiology, Animal metabolism, Adaptation, Resistance.

Life in the sulfide system requires the ability to withstand the toxic effects of long-term sulfide stress. The adaptations of sulfide-system interstitial metazoans to sulfide stress have been investigated using 35S-sulfide. One possible adaptation, the total exclusion of sulfide at the body wall, could not be demonstrated. Sulfide-system turbellarians and gastrotrichs, however, consistently incorporated less 35S-sulfide during a 2-h incubation period than their surface-dwelling counterparts. Analysis of autoradiographs of the sulfide-system acoels Myopea , Solenofilomorpha, and Pseudohaplogonaria sp., and the surface-dwelling proseriate Archiloa revealed major differences in the concentration of 35S label in the body wall relative to the internal tissues. Timed uptake and loss experiments plus data from autoradiography showed that the label in the body wall was not permanently bound but, instead, was easily lost. The data indicate that a sulfide detoxification system exists in the body wall which uses an as yet unknown scavinging system to trap much of the sulfide that enters, detoxifies it, and releases the end-product to the medium. (Deal-EIS)
W79-07652

MERCURY ACCUMULATION IN IPOMOEA AQUATICA (FORSK) NEAR A CAUSTIC SODA FACTORY IN THAILAND,
Helsinki Univ. (Finland). Dept. of Environmental Science.
For primary bibliographic entry see Field 5C.
W79-07653

ALKANES IN PLANKTON FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
For primary bibliographic entry see Field 5C.
W79-07655

MERCURY POLLUTION OF MEDITERRANEAN SEDIMENTS AROUND ALEXANDRIA, EGYPT,
Alexandria Univ. (Egypt). Faculty of Science.
For primary bibliographic entry see Field 5C.
W79-07656

DOMINANCE AND DISTRIBUTION OF BENTHIC MACROPHYTE ASSEMBLAGES IN A NORTH FLORIDA ESTUARY (APALACHEE BAY, FLORIDA),
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W79-07660

KEPONE: TOXICITY AND BIOACCUMULATION IN BLUE CRABS,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W79-07679

THE DISTRIBUTION OF HEAVY METALS IN THE HARD CLAM, MERCENARIA MERCENARIA, IN THE LOWER CHESAPEAKE BAY REGION,
Bigelow Lab. for Ocean Sciences, Boothbay Harbor, ME.
P. F. Larsen.
Estuaries, Vol. 2, No. 1, p 1-8, 1979. 1 fig, 4 tab, 23 ref.

Descriptors: *Clams, *Heavy metals, *Tissue analysis, *Mercenaria, *James River(Virginia), *York River(Virginia), *Cadmium, *Copper, *Zinc, Chesapeake Bay, Commercial shellfish, Salinity, Water chemistry, Chemical analysis.

Populations of the hard clam, Mercenaria mercenaria, were sampled at thirty sites in the lower Chesapeake Bay region in 1972 and 1973. Subsamples were taken for analysis for the trace metals cadmium, copper and zinc. Emphasis was placed on samples from the York and James Rivers, two very productive and commercially utilized clam grounds. The levels of metals determined were comparable to those reported from other regions except Southampton Water in the United Kingdom. Differences in levels between the York and James Rivers were statistically significant ($P < 0.001$) which indicates that the James River probably suffers from contamination by these metals. One metal, copper, varied significantly with the age of the organism whereas the other two, cadmium and zinc, varied with salinity. In Mercenaria the salinity of the sampling site must be considered before cadmium and zinc data can be interpreted. A standard action-level to denote pollution from copper would be adequate in this species. (Deal-EIS)
W79-07685

TRANSPORT, DISTRIBUTION AND TOXIC EFFECTS OF POLYCHLORINATED BIPHENYLS IN ECOSYSTEMS: REVIEW,
Tennessee Univ., Knoxville. Memorial Research Center and Hospital.
For primary bibliographic entry see Field 5C.
W79-07688

DISTRIBUTION AND FRACTIONATION OF ARSENIC IN SELECTED FRESH WATER LAKE SEDIMENTS,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 5A.
W79-07689

CADMIUM SORPTION IN ESTUARINE MUD-TYPE SEDIMENT AND THE ACCUMULATION OF CADMIUM IN THE SOFT-SHELL CLAM, MYA ARENARIA,
District of Columbia Univ., Washington. Mount Vernon Square Campus.
For primary bibliographic entry see Field 5C.
W79-07691

OBSERVATIONS ON THE ENVIRONMENTAL CHARACTERISTICS OF PULICAT LAKE,
Central Inland Fisheries Research Inst. Madras (India).
M. Kaliyamurthy.
Journal of the Marine Biological Association of India, Vol. 16, No. 3, p 683-688, 1974. 4 fig, 18 ref.

Descriptors: *Monsoons, *Lakes, *Water analysis, *Seasonal, Water temperature, Salinity, Dissolved oxygen, Hydrogen ion concentration, Productivity, Fish populations, Tidal effects, Tidal waters, Neritic, Water circulation, India, Pulicat Lake.

Observations made during the years 1968 through 1970 on the spatial and temporal variations in temperature, salinity, dissolved oxygen and pH in Pulicat Lake are presented. Water temperature showed double oscillation in its seasonal changes, whereas salinity had a single peak during May/June. From the mouth to the upper reaches of the lake there was a decreasing salinity gradient during monsoon and postmonsoon, which became more or less reversed during premonsoon and summer. Higher values of dissolved oxygen were observed during monsoon and postmonsoon when compared to summer and premonsoon. Hydrogen ion concentration showed an inverse relationship with oxygen. Wider fluctuations in the environmental parameters were observed in the northern sector of the lake and the probable reasons for this are discussed. An attempt has been made to correlate the variations in salinity with the fish production of the lake. (Deal-EIS)
W79-07694

N15/N14 RATIOS OF GROUND-WATER NITRATE, LONG ISLAND, NEW YORK,
Texas Univ. at Austin. Bureau of Economic Geology.
C. W. Kreitler, S. E. Ragone, and B. G. Katz.
Ground Water, Vol 16, No 6, p 404-409, November-December 1978. 3 fig, 2 tab, 19 ref.

Descriptors: *Nitrogen, *Nitrates, *Isotope studies, *Groundwater, *Water pollution sources, Fertilizers, Animal wastes(Wildlife), *New York, *Long Island(NY), Nassau County(NY), Suffolk County(NY).

Nitrogen-isotope values of nitrate in water from the upper glacial aquifer are lighter in agricultural areas in eastern Long Island than in highly suburbanized areas in western Long Island. This reflects a shift in the dominant source of nitrate from fertilizer nitrogen and/or unfertilized cultivation nitrogen to a predominance of animal-waste nitrogen. Nitrogen-isotope values for nitrate in samples from the Magothy aquifer in Nassau and Suffolk Counties indicate that the nitrate is from a predominantly agricultural source with some animal wastes. Ground water in the Magothy aquifer is older than that in the upper glacial aquifer and should be representative of an older land-use pattern when agriculture was more widely practiced. Nitrogen-isotope values are lighter than those found in the overlying upper glacial aquifer in Nassau County, but heavier than those from the upper glacial aquifer in Suffolk County. (Woodard-USGS)
W79-07697

GROUND-WATER HYDROLOGY AND SUBSURFACE MIGRATION OF RADIOISOTOPES AT A LOW-LEVEL SOLID RADIOACTIVE-WASTE DISPOSAL SITE, WEST VALLEY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. E. Prudic, and A. D. Randall.
In: Management of Low-Level Radioactive Waste, Vol. 2, p 853-882, Pergamon Press, New York, 1979. 14 fig, 2 tab, 10 ref.

Descriptors: *Hydrogeology, *Solid wastes, *Underground, Waste disposal, *Radioactive wastes, *Path of pollutants, Groundwater, Tritium, Nuclear wastes, Infiltration, Groundwater movement, Groundwater recharge, Aquifer characteristics, Sampling, Water analysis, Evaluation, *West Valley(NY).

Burial trenches for disposal of solid radioactive waste at West Valley, N.Y., are excavated in till that has very low hydraulic conductivity (about 5 x 10 to the minus 8th power centimeters per second). Fractures and root tubes with chemically oxidized and/or reduced soil in their walls extend 3 to 4.5 meters below natural land surface. Preliminary simulations of pressure heads with a digital model suggest that hydraulic conductivity is an order of magnitude greater in the fractured till near land surface than at greater depth. Hydraulic gradients are predominantly downward, even beneath small valleys. The upper part of a body of underlying lacustrine silt is unsaturated; in the lower, saturated part, slow lateral flow may occur. In the older trenches, water began to build up in 1971, overflowed briefly in 1975, and was pumped out in 1975-76. Water levels rose abruptly during major rainstorms in mid-1975, indicating rapid infiltration through cracks in the cover material. The new trenche has maintained low, stable water levels, perhaps because of thicker, more compact cover and less waste settlement; pressure heads near these trenches are low, locally approaching zero, perhaps because of slight infiltration and limited near-surface storage. Peak tritium concentrations in test-hole cores (generally 0.00001 to 0.001 microcuries per milliliter) were found within 3 meters of land surface and are attributed to surface contamination. Concentrations declined rapidly with depth within the fractured till; secondary peaks found at about 9 meters in three holes are attributed to lateral migration from trenches. Other radioisotopes were detected only near land surface. Samples from the walls of shallow fractures revealed no accumulation of radioisotopes. (Woodard-USGS)
W79-07713

DETERMINATION OF HYDROLOGIC PARAMETERS FOR GLACIAL TILLS IN CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Re-

sources.
For primary bibliographic entry see Field 2F.
W79-07715

TRACE AND TOXIC METAL UPTAKE BY MARSH PLANTS AS AFFECTED BY EH, PH, AND SALINITY,
Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
For primary bibliographic entry see Field 2K.
W79-07727

THE EFFECT OF LAKE DESTRATIFICATION ON WATER QUALITY,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2H.
W79-07745

NUTRIENT BUDGET ANALYSIS FOR REND LAKE IN ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality, Section.
For primary bibliographic entry see Field 5A.
W79-07748

HYDROCHEMICAL EVIDENCE OF SEA WATER INTRUSION ALONG THE MANGROL-CHORWAD COAST OF SAURASHTRA, GUJARAT,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 2L.
W79-07752

MANAGEMENT OF SMALL WASTE FLOWS.
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W79-07774

THE SOURCES AND BEHAVIOR OF HEAVY METALS IN WASTEWATER AND SLUDGES,
Battelle Columbus Lab., OH.
B. W. Vigon, R. A. Craig, and N. A. Frazier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 006, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-070, 1977. 63 p, 26 tab, 41 ref.

Descriptors: *Heavy metals, *Sewage sludge, *Treatment facilities, *Water pollution sources, *Industrial wastes, Urban runoff, Agriculture, Peak loads, Waste water treatment, Municipal wastes.

A review of the literature available on the point and non-point sources and behavior of heavy metals in municipal waste water treatment plants and in sewage sludges was prepared. Inconsistent results were found in previous studies of heavy metals in municipal waste water. The heavy metal concentrations from residential sources varied significantly with the element studied and the geographic location. The residential contribution of heavy metals was rarely more than 50% of the total load. Inconsistencies among previous studies were attributed to the inclusion of unsurveyed industrial discharges. The correlation of heavy metal content in sludge with industrial density was considered inappropriate since diffuse sources of heavy metals such as laundries, street runoff, and family-owned operations can contribute to concentrations from a supposedly residential section. Because peak flows are usually bypassed, the contribution of urban runoff to metal levels at treatment plants was not considered significant compared to other sources. Individual studies of point-source heavy metals were considered necessary in areas where municipal sewage sludge containing heavy metal concentrations exceeding acceptable limits is used for agricultural purposes. (Lisk-FRC)
W79-07782

RESULTS OF INVESTIGATIONS, T. E. MAXSON WTP AND SIGNIFICANT INDUSTRIAL CONTRIBUTORS, MEMPHIS, TENNESSEE,
Report EPA-904/9-77-005, 1977. 236 p, 10 fig, 65 tab, 13 ref, 5 append.

Descriptors: *Treatment facilities, *Design flow, *Design data, *Pollutant identification, *Discharge measurement, Industrial wastes, Organic loading, Bioassay, Activated sludge, Oxidation lagoons, Waste water treatment, Municipal wastes.

Operation and maintenance investigations, bioassay toxicity studies of plant influent and effluent, and waste characterization studies of significant industrial waste water contributors were performed at the T. E. Maxson waste water treatment plant in Memphis, TN, to determine the capability of the plant to treat present and projected waste loads, to characterize the significant waste sources discharging into the collection system, and to verify previous performance data. The 80 mgd contact stabilization activated sludge plant was designed to reduce BOD by 85% and suspended solids by 90% but study data indicated that the plant achieved removals of 69% BOD, 54% COD, and 45% total suspended solids. The average waste water flow was 49% of the design capacity while the organic loading as BOD was 104% of the design load and as high as 140% on one study day. The plant influent had significant amounts of chlordane, chloroform, ramrod, and terpineol isomer; significant amounts of these substances were also found in the plant effluent. Influent and effluent were toxic to waterfleas and bluegill sunfish; while the toxic compounds could not be identified, chlordane and atrazine found in the waste water had been found toxic in other bioassays. The contact stabilization process and digesters did not receive enough air for proper operation; the plant received shock loadings; restricted hydraulic conditions prevented the plant from operating at design flow; and mechanical problems were identified. Some of the 162 industrial waste water discharges were investigated. (Lisk-FRC)
W79-07788

FINAL REPORT ON FATE OF METALS APPLIED IN SEWAGE AT LAND WASTEWATER DISPOSAL SITES,
Texas A and M Research Foundation, College Station.
K. W. Brown, C. Woods, and J. F. Slowey.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 363, Price codes: A15 in paper copy, A01 in microfiche. Report, 1975. 344 p, 52 fig, 27 tab, 59 ref, 9 append.

Descriptors: *Heavy metals, *Soil types, *Soil profiles, *Leachate, *Lysimeters, Waste water disposal, Copper, Zinc, Cadmium, Nickel, Lead, Bermuda grass, Sampling, Root zone, Waste water treatment, Municipal wastes, Sewage.

The fate of copper, zinc, cadmium, nickel, and lead contaminants in secondary sewage effluent applied to four different soils at waste water disposal sites was investigated. Five undisturbed monoliths of each soil type were enclosed in drainage lysimeters, and field plots of two of the soils were similarly established. The effluent samples, bearing 1 ppm of each of the metal contaminants, were applied at an average rate of 2.7 cm/wk for one year. Rainfall was excluded from the plots. Heavy metal concentrations were analyzed in samples of Bermuda grass, soil samples at a series of depths, and samples of water in the root zone from the bottom of the lysimeters. The total metal content, and the soluble, exchangeable, and organic bond fractions in the soil samples were also investigated. The effects of pH adjustment of the sewage effluent, rainfall, and the application of primary clarified effluent on the fate of the metals were examined. Other hydrologic and meteorological data were also monitored. Metals accumulated primarily in the top 12.5 cm of soil with the greatest concentrations found at the surface. The movement of metals downward through the soils were slow; no metals appeared in leachate collected at 75 cm and 150 cm in any of the soils. Vegetation uptake of the metals was minimal during the study. (Lisk-FRC)
W79-07789

THE SURVIVAL OF HUMAN ENTERIC VIRUSES IN HOLDING PONDS,
Texas Univ. at San Antonio. Center for Applied Research and Technology.
For primary bibliographic entry see Field 5D.
W79-07790

WASHINGTON STATE REFINERIES: PETROLEUM, PETROLEUM DERIVATIVES AND WASTEWATER EFFLUENT CHARACTERISTICS,
Oceanographic Inst. of Washington, Seattle.
J. T. Pizzo, T. L. Johnson, and G. W. Harshman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 401, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/7-78-040, 1978. 169 p, 21 fig, 70 tab, 121 ref, 3 append (on fiche).

Descriptors: *Oil industry, *Oil wastes, *Effluent streams, *Performance, *Waste water treatment, Phenols, Sulfides, Chromium, Water pollution sources, Waste water treatment, Industrial wastes.

Refinery waste water effluent characteristics in Washington State were studied to detail the types of petroleum and petroleum derivatives that potentially could reach the Puget Sound. Information was collected on the chemical characteristics, amounts processed, and final disposition of crude oils, refined products, and waste water effluents associated with the six Puget Sound refineries. The amounts and types of petroleum and its derivatives handled by Puget Sound refineries and the amounts typically reaching marine waters are described. The refining and waste treatment processes employed by area refineries are described in detail. The final treated effluent contains a wide variety of chemical constituents and characteristics as it is virtually impossible to completely eliminate the pollutants which arise from crude oil refining. Average effluent level of phenols was 0.4 ppm, total oils was 5-10 ppm, sulfides was 0 ppm, mercaptans was 0 ppm, and total chromium was 0.1. (Small-FRC)
W79-07799

EVALUATION OF LEACHATE TREATMENT VOLUME 1: CHARACTERIZATION OF LEACHATE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W79-07807

DISCHARGE OF HEAVY METALS TO MUNICIPAL SEWERS 'THE CRUNCH MAY COME',
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
For primary bibliographic entry see Field 5D.
W79-07850

CONTROLLING PCB DISCHARGES TO THE ENVIRONMENT,
New York State Dept. of Environmental Conservation, Albany. Div. of Pure Waters.
N. A. Curry.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, June 13-16, 1976, Toronto, Ontario, p 449-473. (1976) 2 fig, 4 tab, 7 ref, 1 append.

Descriptors: *Polychlorinated biphenyls, *Waste disposal, *Landfills, *Regulation, Leachate, Pesticide residues, Water pollution sources.

The control of PCB discharges to the environment and control over the disposal of discarded units containing PCBs are discussed. Manufacturing plants have discharged PCBs dissolved in the water, adsorbed onto suspended solids, dispersed in droplets, or dissolved in any oil or grease in the water effluent. At the Hudson Falls Plant of General Electric, about 38 ppb PCB was found in the inlet water. After suspended matter was removed, there was less than 1 ppb PCB. Discharges of PCBs tend to cycle from air to water to soil. Past landfills contain an estimated 300,000,000 pounds of PCBs and 750,000,000 pounds are in sealed units

in use. Regulation of disposal of discarded units is required, and new chemical landfills must be provided to contain leachate for complete destruction. Use must be limited and regulated to prevent discharge and rupture. Adequate substitutes for PCBs must be developed. (See also W79-07849) (Small-FRC)
W79-07857

MANUAL FOR THE CONTROL OF HAZARDOUS MATERIAL SPILLS. VOLUME ONE. SPILL ASSESSMENT AND WATER TREATMENT TECHNIQUES,
Envirex, Inc., Milwaukee, WI. Environmental Sciences Div.
K. R. Huibregtse, R. C. Scholz, R. E. Wullschleger, J. H. Moser, and E. R. Bollinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 734, Price codes: A21 in paper copy, A01 in microfiche. Report EPA-600/2-77-227, 1977. 471 p, 94 fig, 45 tab, 83 ref.

Descriptors: *Hazards, *Accidents, *Assessments, Public health, Safety.

A manual for the control of hazardous waste spills using improvised treatment systems is presented. The following topics are covered: notification, information sources, identification and assessment, determination of the best method for spill handling, safety consideration and process design, process construction and operation, and process components and treatment chemicals, and standard operating procedures during cleanup. The manual emphasizes spill control although prevention techniques are reviewed. The CHRIS-Vol. 3 Hazard Assessment is recommended for establishing human danger potential. Necessary treatment schemes are included for 303 hazardous wastes. Necessary safety procedures and process designs are presented. (Small-FRC)
W79-07868

DIFFUSE SOURCE POLLUTION: POLICY CONSIDERATIONS FOR THE STATES.
Council of State Governments, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07879

A REVISION OF EXISTING REGULATIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07883

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

COAL MINE WATER POLLUTION - LEGAL AND REGULATORY ISSUES: A SURVEY,
A. B. Fisher.
Illinois Institute of Natural Resources, Chicago, Illinois, Document No. 78/33, October, 1978, 43 p.

Descriptors: *Coal mine wastes, *Water quality standards, *Water pollution control, Economic impact, Chlorides, Sulfates, Dissolved solids, Effluents, Water pollution, Regulation, Legislation.

Legal and regulatory issues are surveyed regarding coal mine water pollution in 6 states: Colorado; Indiana; Kentucky; Ohio; Pennsylvania; West Virginia; and Wyoming. No state has sought to impose expensive treatment technology upon coal mine operators, but they have resorted to the following strategies: (1) mine discharges being diverted to an alternate watershed (Ohio); (2) violations of water quality standards being ignored (Pennsylvania); (3) water quality standards which would place a burden on coal mine operators not being promulgated in the first place or being easily removed if compliance is economically or technically infeasible (West Virginia); (4) streams which only exist when it rains but which may receive discharges from coal mining operation being excluded from water quality standards (Kentucky); (5) streams or stream segments which have been severely polluted by coal mine drainage through time being exempt from water quality standards (Ohio). Four appendices contain the following information: (1) a comparison of typical coal values for each state; (2) a comparison of the number of bituminous coal mines for each state; (3) the demonstrated coal reserves for each state; and (4) the agency in each state designated to coordinate the 1977 Surface Mining Control and Reclamation Act. (Vloedman-Florida)
W79-07887

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

EXPANDED OFFSHORE LEASING AND THE MANDATES OF NEPA,
J. E. McDermott.
Natural Resources Lawyer, Vol. 10, No. 3, p 531-53, 1977.

Descriptors: *Continental shelf, *Oil, *Leases, *Administrative agencies, Environmental effects, Environment, Oil pollution, Offshore platforms, Administrative decisions, Water pollution, Judicial decisions.

To reduce America's growing dependence on foreign oil, the United States Department of the Interior has been progressing rapidly with its plans for accelerated nationwide oil and gas leasing on the Outer Continental Shelf (OCS). The legality of the Interior's decision to implement accelerated OCS leasing both nationwide and in Southern California is explored. In connection with its decision, the Interior undertook environmental review procedures of questionable legality and propriety: (1) it failed to recirculate for further public comment a draft of a substantially amended programmatic Environmental Impact Statement (EIS); and (2) it undertook significant tract activities, including a tract specific environmental review process in Southern California, before the release of a final programmatic EIS and before the decision to implement the national leasing program. As a result, the integrity of the Interior's decisionmaking process was potentially compromised. More importantly, if the same procedures are adopted by other agencies in similar environmental review contexts, the future viability of the National Environmental Policy Act's environmental review process could be jeopardized. (Fortin-Florida)
W79-07898

ACID COAL MINE DRAINAGE: PAST POLLUTION AND CURRENT REGULATION,
West Virginia Univ., Morgantown. Coll. of Law.
For primary bibliographic entry see Field 6E.
W79-07905

RECENT CONGRESSIONAL ACTION ON OUTER CONTINENTAL SHELF OIL AND GAS DEVELOPMENT,
For primary bibliographic entry see Field 6E.
W79-07906

AN INTENSIVE STUDY OF THE HEAVY HYDROCARBONS IN THE SUSPENDED PARTICULATE MATTER OF SEAWATER,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
P. L. Parker, and S. Macko.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 11-1 - 11-30, 1979. 13 fig, 10 tab. AA550-CT6-17.

Descriptors: *Texas, *Aromatic compounds, *Water pollution sources, Environmental effects, Water pollution effects, Baseline studies, Resources development, *Outer Continental Shelf, *Hydrocarbons, Petrogenic hydrocarbons, Suspended particulates, South Texas Outer Continental Shelf(STOCS).

Samples of particulate matter taken at three stations along Transect II were analyzed by GC and GC/MS/Data System. Total particulate hydrocarbon concentrations were found to decrease with distance offshore. The concentration of higher molecular weight hydrocarbons(C28 - C30) however, remained relatively constant. Such a distribution could be explained by production/introduction of hydrocarbons inshore with subsequent movement offshore. Preferential retention to higher molecular weight hydrocarbons during weathering could account for their more uniform concentration. Polycyclic aromatic compounds were found in benzene eluates of each sample. Among the compounds identified were: alkyl naphthalenes, phenanthrenes and dibenzothiophenes. Fluoranthene and pyrene were also found. A petroleum origin for the aromatics is likely. (Sinha-OEIS)
W79-07922

CHATTAHOOCHEE RIVER THERMAL ALTERATIONS,
Geological Survey, NSTL Station, MS. Water Resources Div. and Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-07936

MODELING HIGHLY TRANSIENT FLOW, MASS, AND HEAT TRANSPORT IN THE CHATTAHOOCHEE RIVER NEAR ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS. Water Resources Div.
H. E. Jobson, and T. N. Keefer.
Geological Survey open-file report 79-270, January 1979. 139 p, 43 fig, 4 tab, 30 ref.

Descriptors: *Open channel flow, *Model studies, *Mathematical models, *Streamflow, *Heat transfer, Thermal pollution, Hydroelectric plants, Reservoir releases, Path of pollutants, Dye releases, Tracking techniques, Tracers, Water temperature, Hydrologic data, Equations, Evaluation, Georgia, *Chattahoochee River, *Buford Dam, *Norcross(Ga), Transport modeling.

A coupled flow-temperature model has been developed and verified for a 27.9-km reach of the Chattahoochee River between Buford Dam and Norcross, Ga. Flow in this reach of the Chattahoochee is continuous but highly regulated by Buford Dam, a flood-control and hydroelectric facility located near Buford, Ga. Calibration and verification utilized two sets of data collected under highly unsteady discharge conditions. Existing solution techniques, with certain minor improvements, were applied to verify the existing technology of flow and transport modeling. A linear, implicit finite-difference flow model was coupled with implicit, finite-difference transport and temperature models. Both the conservative and nonconservative forms of the transport equation were solved, and the difference in the predicted concentrations of dye were found to be insignificant. The temperature model, therefore, was based on the simpler nonconservative form of the transport equation. (Woodard-USGS)
W79-07943

LAND USE INFLUENCES ON METALS IN STORM DRAINAGE,
Geological Survey, Columbus, OH. Water Resources Div.; and Occoquan Monitoring Lab., Manassas, VA; and Virginia Polytechnic Inst. and State Univ., Blacksburg.

D. R. Helsel, J. I. Kim, T. J. Grizzard, C. W. Randall, and R. C. Hoehn.
Journal of the Water Pollution Control Federal, Vol. 51, No. 4, p 709-717, April 1979. 7 fig, 8 tab, 3 ref.

Descriptors: *Water pollution sources, *Heavy metals, *Land use, *Surface waters, *Watersheds(Basins), Runoff, Path of pollutants, Farms, Forests, Urban runoff, Storm runoff, Water analysis, Zinc, Lead, Chromium, Copper, Cadmium, Iron, Manganese, Virginia, *Occoquan watershed, *Four Mile Run watershed.

Swale washoff in rural areas and storm sewer discharges in developed subbasins, are an important factor in the declining water quality of the Occoquan Reservoir in Virginia. Data are presented for the watershed tributary to this reservoir, along with the Four Mile Run watershed near the Washington, D.C., city line. The two basins drain lands ranging from farms and undisturbed forests in the Occoquan headwaters to commercial and high-density residential areas along Four Mile Run. The purpose of the study was to characterize and compare the surface runoff of seven metals from small basins of differing land use types. Many metals are required by organisms as micronutrients. Yet at higher concentrations they can be toxic, with the toxicity level depending on the metal, the organism exposed, and the chemical environment. The metals analysed are zinc, lead, chromium, copper, cadmium, iron and manganese. (Woodard-USGS)
W79-07954

DEVELOPMENT OF METHODS FOR SAMPLING, PRESERVING AND ANALYZING CONTAMINATED GROUND WATERS AND AQUIFER SEDIMENTS,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
A. E. Jackson.
In: Hydrology Research Division, Annual Progress Reports and Short Research Notes, 1977-78. p 32-42, 1979. 7 fig, 8 ref. Environment Canada Inland Waters Directorate, Ottawa, Report Series No. 64. HR 75-1.

Descriptors: *Path of pollutants, *Hydrogeology, Groundwater, *Water pollution, Analytical techniques, Measurements, Aquifer characteristics, Sampling, Sediments, Connate water, Strontium, Cesium, Perch Lake(Canada), Chalk River Nuclear Laboratories.

Progress is reported on the measurement of dissolved and sorbed contaminants in the groundwater flow system of the Lower Perch Lake Basin at the Chalk River Nuclear Laboratories (CRNL). Field measurement and sampling, preservation, and analysis were used to measure the hydrogeochemical parameters of the lake basin. The procedures for these processes and the equipment used are discussed. The method being developed at CRNL to obtain undisturbed samples of contaminated aquifer materials involves the use of a sediment sampler and the separation of the interstitial water from the samples. To determine the distribution coefficients for strontium 90 and cesium 137 the water and sediment samples are counted individually. Flow charts illustrate hydrogeochemical analyses and the procedures for sediment and interstitial water analysis. (Davison-IPA)
W79-07957

TOXIC SUBSTANCES IN OPEQUON CREEK, VIRGINIA,
Virginia State Water Control Board, Richmond.
J. W. Ayers.
Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 189-196, 7 fig, 1 tab, 8 ref.

Descriptors: *Pesticide residues, *Pesticide kinetics, *Pesticide toxicity, *Persistence, *Food chains, Aquatic populations, *Fish, Path of pollutants, Ecosystems, Monitoring, Pesticides, Organic pesticides, DDT, Dieldrin, Endrin, Polychlorinated biphenyls, Water analysis, Water pollution sources, Water quality, Opequon Creek(Virginia).

A 13-month monitoring program was conducted during 1973 and 1974 on the Opequon Creek, Virginia, to examine the extent of biological accumulation of toxic pesticide residues in an aquatic ecosystem. Samples of water, fish, and sediments were analyzed for all pesticide compounds to locate phases of the environment in which pesticide residues were concentrated, to determine variations in seasonal pesticide occurrences, and to evaluate the importance of the food chain in biological accumulation of pesticide residues. Data on pesticide residues in fish tissues and bottom sediments were updated during an August 1976 survey. Pesticides and their uptake by fish are emphasized in a discussion of the theoretical concepts of biological accumulation of toxic substances. Of the 195 water samples analyzed, 38% were contaminated with one or more pesticides. A total of 13 pesticide compounds were found, most of which were organochlorines; organophosphates and herbicides were also present. Pesticide residues in the water correlated with pesticide application activity. The lower food chain level exhibited the highest contamination level; the upper food chain level had the lowest total residue levels of all fish collected, supporting the theory of direct environmental uptake of pesticides. Fish collected at the end of the heavy pesticide application period in August had higher residues than those collected in February, the slack period for pesticide application activity. The results indicate that persistent organochlorine pesticide residues may be diminishing because fewer of these chemicals are used in agriculture. (Davison-IPA)
W79-07975

STORM RUNOFF AND COMBINED SEWERS IN WASHINGTON, D. C.,
American Univ., Washington, DC. Dept. of Biology.
M. A. Champs.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 151-154, 7 fig, 12 ref. Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.

Descriptors: *Combined sewers, *Discharge measurement, *Overflow, *Rainfall-runoff relationships, *Organic loading, *Carbon, *Discharge(Water), *Sewerage, Nutrients, Water pollution, Water pollution sources, Storm runoff, Average runoff, Potomac River, Washington(DC).

Storm loadings of dissolved and particulate organic carbon are summarized for the Washington, D. C. area. Dry flow, street runoff, and combined sewer overflow from residential and industrial areas are compared to the Potomac River yearly averages and storm crests. A National Pollutant Discharge Elimination System Discharge Permit (NPDES) was issued to the District of Columbia for discharges to the Potomac River and its tributaries for 72.2% of the city's total combined sewer acreage. Researchers found that a 'significant portion' of the total storm-water pollutional loads to the streams of the District of Columbia come from combined sewer discharges. Sanitary sewage contributes about half of the organic and more than 50% of the nutrient loadings in combined sewer discharges. The average organic and nutrient concentrations of rainfall runoff are about 1/3 of those in combined sewer discharges in the Washington, D. C. area. Factors affecting the loading intensity in storm and combined sewers and their overflows include: surrounding land use, the time elapsed since streets were cleaned, the degree of cleaning, local traffic volume and type, street surface type and condition, construction practices, public works practices, and season of the year. Dissolved and particulate organic carbon concentrations in street runoff, storm and combined sewers, and overflows were found to be four to 10 times higher than water samples from the Potomac River. (Davison-IPA)
W79-07986

URBAN RUNOFF AND THE STREAM LIFE OF THE OCCOQUAN,
Occoquan Water Shed Monitoring Lab., Manassas, VA.
J. T. Kim, T. J. Grizzard, C. W. Randall, and R. C. Hoehn.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 155-160, 6 fig, 1 tab, 12 ref. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Urban runoff, *Water pollution sources, *Water pollution effects, *Water management, Nutrients, Phosphorus, Nitrogen, Heavy metals, Iron, Lead, Zinc, Rainfall, Runoff, Occoquan Reservoir(Virginia).

The Occoquan Reservoir, on a major tributary of the Potomac estuary, was impounded in 1957 to provide a raw water supply to the Virginia suburbs of Washington, D. C. Although waste water discharges continue to contribute a significant amount of the pollutional load on the impoundment, recent studies show that contribution from runoff sources is clearly important. Data were collected from three sub-basins (Stonewall Road, Irongate, and Manassas Mall) during a compound storm event in August 1976. No runoff occurred for nine days before the event. The precipitation total for each site was the same, but the total runoff volumes varied widely because of differences in impervious area and sub-basin size. The nitrogen (N) and phosphorus (P) content in the runoff exceeded the accepted limits by factors of 25 for N and 100 for P at times. The initial high peak valued appeared at the onset of runoff. Iron concentrations, highest at Irongate and Stonewall Road, were about 90% attached to suspended material. High concentrations of zinc and lead were observed for Irongate and Manassas Mall because of automobile operation at these sites. Although the high concentrations of zinc were within the acceptable ranges for public water supplies, those for lead exceeded the 0.05 mg/l limit. It is concluded that urban areas seem to have the capacity to export water pollutants from storm drainage at sufficient levels so that concern for the aquatic habitat becomes important. (Davison-IPA)
W79-07987

NUTRIENT MODELING,
Hydroscience, Inc., Arlington, TX.
P. J. Young.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 161-166, 5 fig, 3 tab, 2 ref. Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.

Descriptors: *Mathematical models, *Nutrients, *Nutrient removal, *Evaluation, Regression analysis, River basins, River flow, Fluctuations, Nitrogen, Phosphorus, Potomac River, Water pollution, Water pollution sources, Pollution abatement, Luke(Maryland), Little Falls(Maryland), Potomac River basin.

A review of a recent study is presented in which the nutrient levels of the freshwater Potomac were determined, and the effectiveness of controls to lower these nutrient levels was evaluated. The investigation of the relationships between nutrient concentrations and flow included analyses of seasonal effects, sequences within individual runoff events, and regression analyses of concentration and loading rate versus flow. To characterize and determine the controllability of the nutrients reaching the estuary a mathematical model of the upper Potomac River was developed. The model, consisting of 47 segments from Luke to Little Falls, Maryland, is able to handle point and distributed loadings for conservative or non-conservative substances. Three basic steps were followed for each of the three distinct flow periods modeled. Step 1

involved setting up a calculation to include the estimated loadings to the main step from all sources contributing nutrients during the flow period. Step 2 was concerned with estimating the natural background effects and assumed no input from man's activities. The added effects of point sources are taken into account by Step 3. It was demonstrated that nitrogen and phosphorus seemed to behave non-conservatively during summer low flow periods. On an annual basis nitrogen was considered to behave conservatively throughout the basin, but phosphorus continued to demonstrate non-conservative characteristics. The effectiveness of controls to remove nutrients was computed with logarithmic regressions and the modeling analysis. The 11 specific conclusions resulting from this study are presented. (Davison-IPA)
W79-07988

5C. Effects Of Pollution

MONITORING SPAWNING GRAVEL IN MANAGED FORESTED WATERSHEDS, A PROPOSED PROCEDURE,
Corvallis Environmental Research Lab., OR. Ecosystems Modeling and Analysis Branch.
M. A. Shirazi, D. H. Lewis, and W. K. Seim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 273, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA-600/3-79-014, February 1979. 19 p, 2 fig, 3 tab, 8 ref.

Descriptors: *Aquatic habitats, *Spawning, *Water pollution, *Water pollution sources, *Sediments, Fish management, Fish conservation, Ecology, Environmental effects, Salmonids, Streambeds, Sampling, Gravels, Coarse aggregates, Gravimetric analysis, Water analysis, Forest management, Watershed management, Monitoring.

Because silvicultural activities in the Pacific Northwest introduce various levels of sediments and debris into streams degrading the spawning habitats of salmonid fishes, simple, reliable procedures are needed to monitor spawning substrate to assess the possible level of these impacts. A preliminary rationale for conducting such a monitoring program is presented for both individual spawning sites as well as for the entire stream. Spawning takes place in these mountain streams in riffles six to 36 inches deep with a water velocity of 1.5 to 2.5 ft/sec. The proposed monitoring procedure consists of the following steps: (1) select known spawning areas in stretches of a stream being impacted; (2) identify patches of spawning gravel and measure these areas; (3) estimate the range of gravel composition of each spawning riffle by sampling; (4) use a grab sampler under low water conditions after emergence; (5) three gallons or more of gravel to be collected, if gravel is coarse; (6) the gravel is to be wet-sieved on-site and the coarse fraction is to be analyzed volumetrically; (7) collect remaining gravel in 63 micron sieve, dry sieve in the laboratory and analyze gravimetrically; (8) estimate gravel density, combine analysis and determine geometric mean diameter; and (9) make a matrix--geometric mean diameter of all patches along the stream reach for comparison after impact. (Davison-IPA)
W79-07503

EFFECTS OF THERMAL DISCHARGE ON AQUATIC INSECTS IN THE TENNESSEE VALLEY,
Tennessee Valley Authority, Muscle Shoals, AL. Div. of Environmental Planning.
K. J. Tennesson, and J. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 415, Price codes: A04 in paper copy, A01 in microfiche. Interagency Energy/Environment Research and Development Program Report No. TVA/EP-78-09 and EPA-600/7-78-128, July 1978. 60 p, 24 fig, 9 tab, 12 ref. E-AP 80-BDR.

Descriptors: *Biology, *Animal growth, *Thermal stress, *Biorhythms, *Insects, *Growth stages, *Environment, Thermal pollution, Heat resistance, Heated water, Hydrology, Limnology, Electric powerplants, Water pollution sources, Fecundity.

The burrowing mayfly, Hexagenia bilineata (Say), and the midge, Coelotanypus sp., were studied to determine their thermal tolerances, and to investigate their growth and emergence in the vicinity of Tennessee Valley Authority electric generating plants. The stages of the life cycle subject to thermal discharge from the electric generating plants were emphasized and include the eggs, the immatures (stationary or drifting), and the stage of emergence to the adult. The immature stages of both species showed great tolerance to thermal shocks of up to 20C, a greatly reduced mean percentage of hatching resulted when eggs were subjected to a shock of 15C, and egg development was limited at a constant temperature of 37C. Nymphal growth was greater in areas where the thermal plume extends to the bottom during the winter and spring than in ambient areas. In late spring development in the ambient areas accelerated, and adults emerged at about the same date in both areas. No significant differences in size and fecundity were observed for H. bilineata females emerging from either area, but males emerging from thermal plume areas were larger than those emerging from ambient areas. The differences in mayfly biology were not expected to adversely affect the species in the study area. (Davison-IPA)
W79-07505

INFLUENCE OF A BARITE TAILINGS POND RUPTURE ON THE FISHES OF BIG RIVER, MISSOURI,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
C. H. Hocutt, J. R. Stauffer, Jr., and P. A. Mills.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Proceedings of a Symposium, U.S. Fish and Wildlife Service, Morgantown, West Virginia, December 1978. Report No. FWS/OBS-78/81, p 177-189, 1978. 1 fig, 11 tab, 35 ref.

Descriptors: *Water pollution, *Environmental effects, *Fish populations, *Fish behavior, *Water pollution effects, Sampling, Aquatic environment, Turbidity, Water quality, Mine wastes, Strip mine wastes, Big River(Missouri), Mill Creek(Missouri), Buss Branch(Missouri).

The fish of the Big River, Mill Creek, and Buss Branch in Missouri were sampled at 27 stations during 1975 and 1976 to determine the effects of a barite tailings pond rupture on these fish. Twenty-two stations located above and below the discharge points of Buss Branch into Mill Creek and Mill Creek into Big River were sampled during 1975, and data obtained were compared with sampling results obtained just prior to the tailings pond rupture. This comparison showed that Mill Creek, where the tailings pond was located, suffered a nonselective stress and the fish community was reduced in numbers of species and specimens; the effects of the tailings pond rupture on the fish community of Big River were negligible. During the 1976 survey the 18 stations sampled did not necessarily correspond to those sampled in 1975, because the study objectives differed. Condition factors were calculated for several species to determine if the spill had long-term indirect effects on their healthiness. The fish populations of Mill Creek had recovered significantly in 1976, so that they were probably equivalent to those before the spill. (Davison-IPA)
W79-07507

INERTIA AND ELASTICITY AS A STREAM CLASSIFICATION SYSTEM: YOUGHIOGHENY RIVER CASE HISTORY EVALUATION,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
J. R. Stauffer, Jr., C. H. Hocutt, M. L. Hendricks, and S. L. Markham.
In: Surface Mining and Fish/Wildlife Needs in the Eastern United States, Proceedings of a Symposium, U. S. Fish and Wildlife Service, Morgantown, West Virginia, December 1978, Report No. FWS/OBS-78/81, p 105-118, 1978. 1 fig, 6 tab, 28 ref.

Descriptors: *Rivers, *Eutrophication, *Mining wastes, *Environmental effects, *Watershed management, *Habitat improvement, *Youghiogheny River, Sampling, Fish population, Streams, Monitoring, Fish migration, River systems, Wildlife management, Aquatic habitats, Ecosystems.

The feasibility of using a stream classification system based on the concepts of inertia and elasticity as applied to data obtained on the Youghiogheny River is examined. Inertia, the ability of a stream to withstand a particular stress without eliciting a structural or functional change, can be calculated before a stress occurs. Elasticity is the ability of a system to recover once functional or structural change has occurred. Since only half the parameters used to calculate elasticity can be evaluated prior to stress because the type and intensity of a potential stress is unknown, inertia may be more useful in establishing a stream classification system. Structural and functional redundancy are major factors for calculating inertia. It is noted that functional redundancy was based only on tropic-level interaction. Structural redundancy, calculated by counting the number of species present in a particular family, implies functional redundancy. It was observed that areas with the highest inertia were not necessarily highest in elasticity. It is concluded that high inertia, low elasticity areas should be strictly managed as refugia. (Davison-IPA)
W79-07508

AN EMPIRICAL TRANSPORT MODEL FOR EVALUATING ENTRAINMENT OF AQUATIC ORGANISMS BY POWER PLANTS,
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 7B.
W79-07515

OPPORTUNITIES FOR MAINTENANCE REHABILITATION OF RIPARIAN HABITATS: EASTERN UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., J. R. Stauffer, Jr., and C. H. Hocutt.
In: Strategies for Protection and Management of Floodplain Wetlands and Other Riparian Ecosystems, National Symposium, December 11-13, 1978, Callaway Gardens, Georgia, Johnson, R. R., and McCormick, J. F., Eds., p 304-317, 1979. 10 tab, 31 ref. U.S. Dept. of Agriculture, Forest Service, Washington, DC. GTR-WO-12. E-(40-1) 4939.

Descriptors: *Riparian waters, *Maintenance, *Rehabilitation, *Ecosystems, Baseline studies, Biological properties, Chemical properties, Physical properties, Pollutants, Monitoring, Evaluation, Aquatic habitats, Aquatic organisms.

The maintenance of ecosystem quality requires the following basic components: (1) a baseline biological-chemical-physical study of the present condition; (2) a hazard evaluation based on knowledge of known potential pollutants entering the system and the estimated biological response to them; and (3) a biological-chemical-physical monitoring system designed for early warning of imminent harm. Difficulties encountered in the rehabilitation of an ecosystem include: (1) the original condition may not be known, (2) the ecological means of rehabilitation may not be possible or understood, (3) the cost may be prohibitive, and (4) a species may have been genetically altered after a long exposure to a man-made phenomenon. Two examples in which society's resistance to ecosystem rehabilitation was overcome are discussed. The characteristics of ecosystem vulnerability include inertia, the ability of a system to resist displacement of structural and functional characteristics, and elasticity which is the ability to recover from damage. Calculations of inertia indices and elasticity indices are presented. All of the parameters suggested can be used to calculate the inertia index, but the practical use of the elasticity index is limited by the lack of present information on dispersal rates of fishes and other aquatic organisms. It is concluded that maintenance and rehabilitation of riparian habitats in the eastern United States is possible with existing technology, and that water quality can be maintained through biological assessment and monitoring. (Davison-IPA)

W79-07518

LARVAL FISH DISTRIBUTION IN SOUTHWESTERN LAKE ERIE NEAR THE MONROE POWER PLANT,
Michigan State Univ., East Lansing. Inst. of Water Research.
R. A. Cole.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 629, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-069, July 1978. 73 p, 3 fig, 10 tab, 23 ref, 1 append. R804517010.

Descriptors: *Fish populations, *Fish migration, *Larvae, *Entrainment, *Electric power production, *Western Lake Erie, Environmental effects, Sampling, Equipment, Plankton nets, Ecosystems, Fish establishment, Density, Turbidity, Turbulence.

Quantitative sampling of larval fish in western Lake Erie and the sampling techniques employed are discussed. Daytime and nighttime tows of 1-m plankton nets were used to sample distributions in the coastal zone. Here, the larvae occur in very dilute, shifting, aggregated concentrations. Studies were conducted to contrast day and night sampling efforts and densities in different levels of the water column. The larvae of all abundant fish species near the Monroe Powerplant concentrated near the bottom during the day and dispersed throughout the water column at night, implying that representative daytime sampling depends on the effectiveness of the gear next to the bottom. Depth, turbidity and turbulence vary with distance from shore and could influence gear effectiveness during daytime studies. Larval fish were sampled in flooded tributary valleys and backwaters to contrast with samples from the beach front and further offshore. Prolarvae were concentrated near spawning sites; larvae reaching the lake were rapidly dispersed by currents. Density and mortality sampling in the powerplant cooling system revealed certain larval species were more vulnerable to entrainment: gizzard shad were more vulnerable than yellow perch, white bass, carp, and goldfish. (Davison-IPA)
W79-07519

EFFECTS OF SUSPENDED DREDGED MATERIAL ON AQUATIC ANIMALS,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5E.
W79-07523

AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL SITE, OHIO, APPENDIX C, INVESTIGATION OF WATER-QUALITY AND SEDIMENT PARAMETERS,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
R. K. Wyeth, and R. A. Sweeney.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-42, July 1978. 344 p, 3 append, 15 tab, 106 fig, 33 ref.

Descriptors: *Aquatic environment, *Lake Erie, *Sediments, *Water quality, Benthos, *Dredged material, *Ashtabula River.

An investigation to evaluate impacts of the release of dredged material on chemical aspects of the aquatic and benthic environments was conducted in Lake Erie off Ashtabula, Ohio, from June 1975 through September 1976. Samples and measurements were taken prior to, during, and after the release of materials from a hopper dredge during August 1975 and May 1976. The impact on the water column was short-lived with a return to ambient pre-disposal conditions for most parameters within 90 minutes after release of dredged material. Impacts on interstitial water generally dissipated in less than 90 days after disposal. The benthic environment was the most affected in terms of chemical changes. A return to predisposal conditions did occur within a year primarily due to erosion. There was no evidence of heavy metals accumulations by either benthos or fish as a consequence of disposal of dredged material. A Standard Elutriate Test preparation time dependency study also was done. This investigation resulted in some suggested changes for improving reliability. (WES)
W79-07525

RESPONSE OF PHYTOPLANKTON AND BACTERIA TO WATER QUALITY IN THE CHOWAN RIVER, NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Botany.
O. C. Boody, IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 301, Price codes: A08 in paper copy, A01 in microfiche. MS Thesis, 156p, 1979. 26 fig, 2 tab. OWRT B-091-NC (1), 14-34-0001-6104.

Descriptors: *Phytoplankton, Water quality, *Algal growth, Algal blooms, Nitrogen, Organic phosphorus, *Primary productivity, Chowan River.

Simultaneous in situ measurements of primary productivity and heterotrophic activity using a new apparatus indicated daily and seasonal variations in activity. Using a single, uniformly labeled substrate (14C-glucose) at tracer levels, diurnal heterotrophic activity was measured as percentage uptake and mineralization. Primary productivity was measured using labeled (14C)NaHCO3 at four hour intervals throughout the daily photic period. Daily variation in peak bacterial activity was as much as 0.36% hr-1 to 13.8% hr-1. Variation in bacterial activity was also observed on a seasonal basis. Activity during summer and spring was generally highest during the hours before or just after sunrise. Autumn and winter activity, although lower than summer and spring, was at higher levels during the photic period. Primary productivity ranged from 2.73 x 10-3 u g Cl-1 hr-1 to 2.51 u g Cl-1 hr-1 at Tunis, N.C. and from 3.04 u g Cl-1 hr-1 to 6.66 u g Cl-1 hr-1 at Colerain, N.C. Algal productivity was generally skewed with peak activity during early morning. Population studies of algal and bacteria were undertaken at both Tunis and Colerain. Both populations were highest in summer and spring. The dominant algal groups during the summer were Diatoms at Tunis and Blue-greens at Colerain. Nutrient analyses indicated that winter buildup of inorganic N and inorganic P occurs and these elements are available for spring blooms when water temperature and light conditions become conducive. Multiple linear regressions of algae and bacteria populations vs. nutrient and some physical data were run to detect correlations. (Kiger-North Carolina)
W79-07568

SCREENING AQUATIC ECOSYSTEMS FOR MUTAGENS WITH FERN BIOASSAYS,
Massachusetts Univ., Amherst. Dept. of Botany.
For primary bibliographic entry see Field 5A.
W79-07588

BACTERIAL SUPPRESSION OF CHLORELLA BY HYDROXYLAMINE PRODUCTION,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
P. S. Berger, J. Rho, and H. B. Gunner.
Water Research, Vol. 13, p 267-273, 1979. 6 fig, 1 tab, 31 ref. OWRT B-058-MASS(2). 14-34-0001-7161.

Descriptors: *Algal control, Aquatic microbiology, *Biocontrol, *Chlorella, Algal toxins, Bacteria, Eutrophication, Nitrification, Hydroxylamine.

An actively nitrifying Arthrobacter sp. isolated from a lake inhibited the growth of Chlorella vulgaris. This was found to be due to hydroxylamine released by the bacterium during the oxidation of ammonium or other reduced nitrogen compounds. Plates containing Plate Count Agar streaked with Arthrobacter accumulated 5 micrograms ml-1 hydroxylamine-N. Chlorella was sensitive to less than 0.24 micrograms ml-1 hydroxylamine-N. Non-nitrifying bacterial isolates of lacustrine origin did not demonstrate inhibiting activity. Results indicate that nitrifying microorganisms may thus affect the population dynamics of algae in eutrophic lakes. (Godfrey-Mass)
W79-07589

DRINKING WATER AND HEALTH. PART I, CHAPTERS 1-5. A REPORT OF THE SAFE DRINKING WATER COMMITTEE,
National Academy of Sciences, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 422, Price codes: A25 in paper copy, A01 in microfiche. 1977. 582 p, 5 fig, 38 tab, 962 ref.

Descriptors: *Potable water, Water quality standards, *Microorganisms, *Suspended solids, *Solutes, *Public health, Toxicity, Water pollution effects, Lead, Arsenic compounds, Pesticides, Radioisotopes, Radiation, Chlorination.

A literature review is presented of the effects of the constituents of drinking water on human health. The risk to man was evaluated on the basis of both epidemiological studies and studies of toxicity in laboratory animals. Five classes of contaminants were investigated: microorganisms, particulate matter, inorganic solutes, organic solutes, and radionuclides. Chlorine has controlled microorganisms to an appreciable extent (10,000 cases of waterborne enteric disease were confirmed in 1975), but there are questions concerning toxicity of by-products and residuals in the distribution system. Fine particles are suspended in drinking water which may decrease the efficiency of disinfection, act as contaminant carriers, or perhaps produce toxic effects. Health effects associated with 22 inorganic solutes were reviewed, and reexamination of the current standards for lead, arsenic, and selenium was recommended. One hundred and twenty nine organic compounds including 55 pesticides were examined. Lifetime exposure risk of 22 known or suspected carcinogens was estimated, and an Acceptable Daily Intake (ADI) was calculated for 45 compounds judged potentially toxic but not carcinogenic. Radiation associated with water supplies is usually a small proportion of background radiation, but in a few cases, radium can reach concentrations that pose a higher risk of bone cancer. (See also W79-07591) (Small-FIRL)
W79-07590

DRINKING WATER AND HEALTH PART 2, CHAPTERS 6 AND 7, A REPORT OF THE SAFE DRINKING WATER COMMITTEE,
National Academy of Sciences, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 423, Price codes: A23 in paper copy, A01 in microfiche. 1977, 508 p.

Descriptors: *Toxins, *Water sampling, *Pollutant identification, Chemical analysis, Toxicity, Water quality control, Pesticide toxicity, Water quality standards, Water supply, Insecticides, Herbicides, *Potable water, *Public health.

The potentially harmful effects on human health of some of the impurities in drinking water were studied. The organic contaminants identified in drinking water comprise a small fraction of the total organic matter present. Although approximately 90% of the volatile organics in drinking water have been identified and quantified, these represent no more than 10% of the total organic material. Only 5-10% of the non-volatile organic compounds, have been identified which comprise the remaining 90% of the total organic material in water. A cautious approach must be adopted when dealing with potentially harmful chemicals. For many of the organic compounds identified in drinking water, virtually no toxicity data is available. To determine those agents for which data is most needed, the following assignment of priorities was made: (1) The relative compound contration and the number of persons likely to be exposed; (2) The number of water systems in which the compounds occur; (3) Positive response to in virto (a) mutogenic screening systems; and (b) carcinogen pre-screening; (4) Similarity of a compound's chemical structure to others having defined toxic

properties; (5) Relationship of dose from water to total body burden. (See also W79-07590) (Fortin-Florida)
W79-07591

MICROBIOLOGICAL STUDIES ON THE NITROGEN CYCLE IN AQUATIC ENVIRONMENTS - V NITROGEN METABOLISM IN THE GOLDFISH CULTURING POND,
Kyoto Univ., (Japan). Research Inst. for Food Science.
For primary bibliographic entry see Field 5B.
W79-07592

PSEUDODACTYLOGYRUS MICRORCHIS (MONOGENEA) ON THE GILLS OF CULTURED EELS-III EXPERIMENTAL CONTROL BY TRICHLORFON,
Fukui Prefecture Fisheries Experimental Station, Tsuruga (Japan).
R. Imada, and K. Muroga.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 1, p 25-29, 1979. 3 fig, 1 tab, 4 ref.

Descriptors: *Animal parasites, *Worms, *Eels, *Pseudodactylogyrus, *Trichlorfon, *Formalin, Pesticides, Pesticide toxicity, Chlorinated hydrocarbon pesticides, Chlorides, Toxicity, Growth stages, Aquiculture, Fish parasites, Bioassay, Fish diseases, Fish, Fish hatchery.

In the first experiment, the effects of trichlorfon, formalin and sodium chloride baths on the control of Pseudodactylogylus microrchis on eels (Anguilla anguilla) were studied. 0.5 ppm.24 hour-bath of trichlorfon proved to be potentially practical in both effectiveness and harmlessness. In the second experiment, the effective method of treatment with 0.5 ppm-24hour trichlofon bath was examined. A double 0.5ppm-24 hour-bath of trichlorfon with an adequate interval was confirmed to be completely effective for the control of the worm. The second bath was found to be indispensable, because the eels became reinfected with the young forms hatched from eggs which were laid during the first bath. The interval between the first bath and the second bath depends on the time required for hatching of the eggs. A 3 day interval proved adequate at the experimental water temperature of 25.5-28C. (Deal-EIS)
W79-07593

GROWTH AND PRODUCTION OF AMPHIPODS GAMMARUS OLIVII AT DIFFERENT TEMPERATURES,
Akademiya Nauk USRS, Sevastropol. Dept. of Physiology of Aquatic Animals.
G. I. Abolmasova.
The Soviet Journal of Marine Biology, Vol. 4, No. 3, p 655-659, 1978. 1 fig, 3 tab, 14 ref. (Translated from Russian).

Descriptors: *Water temperature, *Growth rates, *Productivity, *Amphipoda, *Gammarus, Animal physiology, Growth stages, Crustaceans, Size, Mathematical studies, Biomass, Seasonal, Respiration, Animal metabolism.

The equation of dependence between the mass of Gammarus olivii before and after moulting at 5, 10, and 20C is calculated. It is shown that the absolute value of body mass increment during moulting is in direct proportion to the mass up to coulting. The empirical growth curves are S-shaped. The curves constructed on the basis of observations are in good agreement with the growth curves calculated in relation to phsiological indicators. The author demonstrates that with the increase of temperature the specific growth rate increases accordingly. (Deal-EIS)
W79-07595

REVIEW OF OXYGEN DEPLETION AND ASSOCIATED MASS MORTALITIES OF SHELLFISH IN THE MIDDLE ATLANTIC BIGHT IN 1976,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
F. W. Steimle, and C. J. Sindermann.
Marine Fisheries Review, Vol. 40, No. 12, p 17-26, 1978. 6 fig, 41 ref.

Descriptors: *Mortality, *Clams, *Oxygen sag, *Middle Atlantic Bight, Eutrophication, Oxygen, Lobsters, Migration patterns, Migration, Fish migration, Animal behavior, Commercial shellfish, Biological communities, Waste disposal, Weather data, Weather patterns, Continental shelf.

In summer and autumn of 1976, mass mortalities of shellfish occurred in a 165-km long corridor of severe oxygen depletion paralleling the New Jersey coast from 5 to 85 km from shore. Mortalities of surf clams, Spisula solidissima, the most severely affected species, were estimated in excess of 140,000 t. Alteration of normal migration patterns of lobsters and several species of finfish was also noted. A series of anomalous meteorological and hydrological events (particularly early warming of surface waters resulting in early thermocline development, and a massive shelf-wide phytoplankton bloom) superimposed on an already stressed coastal area, was considered to be responsible. The occurrence is particularly significant because the continental shelf of the Middle Atlantic Bight, from Cape Cod to Cape Hatteras on the east coast of the United States, contains the largest known stocks of ocean shellfish of any comparable coastal area of North America. (Deal-EIS)
W79-07596

ELEMENTAL DISTRIBUTION IN RELATION TO SKIN NECROSES OF MARINE FLATFISHES FROM THE ENGLISH CHANNEL,
Westfield Coll., London (England). Dept. of Zoology.
P. F. Newell, T. C. Appleton, B. E. Brown, and J. W. Carnwarth.
Marine Biology, Vol. 51, p 93-99, 1979. 2 fig, 4 tab, 31 ref.

Descriptors: *Industrial wastes, *Fish diseases, *Fish parasites, *Skin necrosis, *Fin lesions, *Flatfish, *Limanda, *Pleuronectes, Platichthys, *Solea, *Tissue analysis, Animal pathology, Fish populations, Chemical analysis, Spectroscopy, Chemical wastes, Trace elements, Metals, Heavy metals, Sodium, Magnesium, Aluminum, Phosphorus, Sulfur, Chlorine, Potassium, Calcium, Iron, Copper, Zinc, Chromium, Water chemistry, Cadmium, Cobalt, Manganese.

It has been suggested that industrial waste discharges are associated with the occurrence of fin damage and skin lesions. A mixed population of diseased and healthy flatfish consisting of Limanda limanda, Pleuronectes platessa, Platichthys flesus and Solea solea were collected from an industrialised area (Calais, France) and were compared with diseased and healthy L. limanda caught in a non-industrialised area (Brixham, England). Analysis of skin samples from necrosed and healthy fish by X-ray microanalysis and atomic absorption spectroscopy has shown that no elemental accumulation occurs either in necrosed fish, or fish from an industrialized area. The fish from Calais were heavily infested with the ectoparasitic copepod Lepeophtheirus pectoralis (O.F. Muller) and, although few were found on fish from Brixham, it is unlikely that this infestation was related to the discharge of industrial effluents. (Deal-EIS)
W79-07597

METHYLMERCURY: REPRODUCTIVE AND BEHAVIORAL EFFECTS ON THREE GENERATIONS OF MALLARD DUCKS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
G. H. Heinz.
Journal of Wildlife Management, Vol. 43, No. 2, p 394-401, 1979. 6 tab, 25 ref.

Descriptors: *Mallard duck, *Mercury, *Toxicity, *Methylmercury, *Bird eggs, *Tissue analysis, *Bioaccumulation, Heavy metals, Animal behavior, Animal physiology, Reproduction, Growth stages, Hatching, Nests, Path of pollutants.

Three generations of mallard ducks were fed either a control diet or a diet containing 0.5 ppm mercury in the form of methylmercury. The levels of mercury in adult tissues and eggs remained about the same over 3 generations. The methylmercury diet had no effect on adult weights or weight changes during the reproductive season. Females fed a diet containing 0.5 ppm mercury laid a greater percentage of their egg outside their nestboxes than did controls, and also laid fewer eggs and produced fewer ducklings. Metylmercury in the diet appeared to result in a small amount of eggshell thinning. Ducklings from parents fed methylmercury were less responsive than controls to tape-recorded maternal calls, but were hyper-responsive to a frightening stimulus in avoidance tests; there were no significant differences in locomotor activity in an open-field test. (Deal-EIS)
W79-07598

EFFECT OF HIGH CONCENTRATIONS OF PETROLEUM AND PHENOL ON THE METABOLISM OF NUCLEIC ACIDS OF ALGAE MACROPHYTES,
Institute of Biology of Southern Seas, Sevastopol (USSR). Dept. of Marine Sanitary Hydrobiology.
I. A. Divavin, O. G. Mironov, and I. M. Tsymbal.
The Soviet Journal of Marine Biology, Vol. 4, No. 1, p 542-544, 1978. 1 tab, 6 ref. (Translated from Russian).

Descriptors: *Biochemistry, *Toxicity, *Phenols, *Oil, Oil spills, *Nucleic acids, *DNA, *RNA, Chlorophyta, Rhodophyta, Phaeophyta, Marine algae, Metabolism, Chemical reactions, Chemical analysis, *Plant physiology.

The authors describe the change in content of free nucleotides RNA and DNA in green (Enteromorphia intestinalis, Bryopsis plumosa), red (Callithamnion corymbosum), and brown (Scytosiphon lomentaria) algae under the effect of petroleum and phenol taken separately and combined in concentrations of 0.5 and 0-2.0 ml/liter and g/liter, respectively. It is found that petroleum is a stronger toxin than phenol. Different reactions of different species of algae to the effect of toxicants are discovered. The authors hypothesize that the changes in free nucleotide content are due to the disruption of biosynthesis of nucleotides and nucleic acids. (Deal-EIS)
W79-07599

UPTAKE OF METHYLAMINE (AN AMMONIUM ANALOGUE) BY MACROCYSTIS PYRIFERA (PHAEOPHYTA),
California Inst., of Tech., Corona Del Mar. Kerckhoff Marine Lab.
For primary bibliographic entry see Field 5B.
W79-07600

AVAILABILITIES OF THREE IRON COMPOUNDS AS DIETARY IRON SOURCES FOR RED SEA BREAM,
Kyushu Univ., Fukuoka, (Japan). Fisheries Research Lab.
S. Sakamoto, and Y. Yone.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 2, p 231-235, 1979. 5 tab, 14 ref.

Descriptors: *Fish diets, *Iron, Fish hatchery, *Bream, *Chrysophrys, *Tissue analysis, Chlorides, Fish management, Aquiculture, Biochemistry, Amino acids, Absorption, Chemical analysis, Chelators, Acids, Enzymes.

Two experiments were conducted to compare the availability of ferrous chloride, ferric chloride, and ferric citrate as the iron sources in the diet for red sea bream, Chrysophrys major. Iron contents of the test diets were adjusted to approximately 15 mg per 100 g of diet in experiment I, and 20 mg per 100 g in experiment II. Fish were reared on the test diets at 25 degrees C over a 73-day period (Exp. I) and over a 90-day period (Exp. II). At the end of the feeding trial, hematological examinations and chemical analyses of the blood serum were conducted. At the 15 mg Fe per 100 g diet level, fish fed the diet supplemented with ferric citrate showed a slight iron deficiency anemia, but fish fed the diets with supplemental ferrous chloride and ferric chloride did not. On the other hand,

: the 20 mg Fe per 100 g diet level, no anemia was ound in the ferric citrate group. Therefore, it is oncluded that the amount of ferrous chloride and erric chloride required for the prevention of iron eficiency anemia corresponds to 15 mg Fe per 00 g diet, and that of ferric citrate corresponds to 0 mg Fe per 100 g diet. (Deal-EIS)
/79-07602

ORRELATIONS BETWEEN DAPHNIA IAGNA AND FATHEAD MINNOW (PIME-HALES PROMELAS) CHRONIC TOXICITY ALUES FOR SEVERAL CLASSES OF TEST UBSTANCES,
rocter and Gamble Co., Cincinnati, OH. Ivory-ale Technical Center.
or primary bibliographic entry see Field 5A.
/79-07603

IELDRIN POLLUTION IN THE RIVER IOLME CATCHMENT, YORKSHIRE,
Ianchester Univ. (England).
. Brown, E. G. Bellinger, and J. P. Day.
nvironmental Pollution, Vol. 18, p 203-211, 1979. fig, 3 tab, 18 ref.

Descriptors: *Dieldrin, *Pesticide residues, Sewage effluents, *Textile industry, Pesticide ki-etics, Chlorinated hydrocarbon pesticides, Organ- compounds, Path of pollutants, Industrial astes, Chemical wastes, Textiles, Water chemis-y, Bottom sediments, Particle size.

Dieldrin concentrations were measured during 976 and 1977 in the River Holme and some of its ributaries, Yorkshire, England. The presence of ieldrin arises from its use as a mothproofer in the extile industry. Concentrations were measured rom both water and sediment samples from each te. The highest levels of dieldrin were found elow sewage works outfalls as the textile mills ere discharging their effluent to sewer, not direct ito the river. Stations above sewage outfalls had ower concentrations. Less than 30% of the diel-rin was associated with particles of less than 0.7 illimicrons in diameter. Concentrations of diel-rin in this river catchment were thought to be igh enough to have a biological effect and this spect was briefly discussed. (Deal-EIS)
/79-07604

CCUMULATION OF CADMIUM BY ARTE-IIA SALINA,
Queen Mary Coll., London (England). Dept. of oology and Comparative Physiology.
. R. Jennings, and P. S. Rainbow.
Iarine Biology, Vol. 51, p 47-53, 1979. 2 fig, 2 tab, ref.

Descriptors: *Brine shrimp, *Cadmium, *Food hains, *Bioaccumulation, Tissue analysis, Path of ollutant, Heavy metals, Animal physiology, nimal metabolism, Chemical analysis, Digestion, bsorption, Phytoplankton, Crabs, Tracers, Ra-ioactivity, Techniques, Radioisotopes,.

The relative importance of accumulation of cadmi-m by Artemia salina directly from solution and rom ingested food has been studied at 3 cadmium oncentrations (0.1, 1 and 10 ppm) under con-rolled experimental conditions. At each cadmium oncentration, A. salina were exposed to cadmium n 4 ways; in solution; in solution the presence of atex 'food' particles; in solution with cadmium-ich Dunaliella tertiolecta as a food source; and to admium-rich D. tertiolecta alone. Net accumula-ion of cadmium by A. salina continued throughout days exposure under all 4 conditions. When the rine shrimp were removed to cadmium-free con-itions, their accumulated cadmium concentrations eclined and levelled off to a stabilised plateau fter 10 days. From consideration of these stabi-sed levels it was shown that at least 30% of admium accumulation directly from solution ccurs via uptake through the alimentary tract. At ower cadmium exposures uptake from food is the ajor route for cadmium accumulation, but at igher exposures the cadmium-saturated food ource displaced cadmium-rich water from the gut nd therefore actually inhibited cadmium accumu-lation. This study, therefore, concludes that the food chain will be the major source of cadmium as long as the previous trophic level has the ability to accumulate the metal to such an extent as to make it more available to the consumer than by direct uptake from seawater. (Deal-EIS)
W79-07605

TOXICITY OF CADMIUM CHLORIDE AND LEAD NITRATE TO CHIRONOMUS TENTANS LARVAE,
Vikram Univ., Ujjain, (India) School of Studies in Zoology.
H. S. Rathore, P. K. Sanghvi, and H. Swarup.
Environmental Pollution, Vol. 18, p 173-177, 1979. 1 tab, 17 ref.

Descriptors: *Cadmium, *Lead, *Toxicity, *Diptera, *Tissue analysis, *Textile industry, Chlorides, Nitrates, Heavy metals, Larval growth stage, Food chains, Fish food organisms, Chemical wastes, Pulp wastes, Protein.

Chironomid larvae form an important link in aquatic food chains. Effluents from textile and pulp mills contain cadmium and lead salts which are dangerous to chironomid larvae, an important fish food. Toxicities of cadmium chloride and lead nitrate were studied under experimental conditions and the mean survival time and LD100 values were calculated. The LD100 values were 20 and 70 ppm for cadmium chloride and lead nitrate, respectively. Results suggest that following poisoning by CdCl2 the total protein contents of the chironomid larvae decrease. This may diminish the nutritive value of these larvae as fish food. Qualitative analysis of larvae following exposure to CdCl2 and Pb(NO3)2 showed that these heavy metals were taken up by the chironomids. (Deal-EIS)
W79-07606

EFFECT OF METHAMIDOPHOS ON THE GROWTH RATE AND ESTERASE ACTIVITY OF THE COMMON CARP CYPRINUS CARPIO L.
Malaya Univ., Kuala Lumpur (Malaysia). Dept. of Zoology.
Y. N. Chin, and K. I. Sudderuddin.
Environmental Pollution, Vol. 18, p 213-219, 1979. 2 fig, 2 tab, 12 ref.

Descriptors: *Carp, *Growth rates, *Enzymes, *Toxicity, *Methamidophos, *Carbaryl, *Lindane, Tissue analysis, *Acetylcholinesterase, *Carboxylesterase, Diquat, Fry, Poisons, Inhibitors, Fish physiology, Animal metabolism, Insecticides, Fish behavior.

The acute toxicity of methamidophos and three other compounds to fingerlings of the common carp was determined. The 96-h LC50 values were 68 mg/litre for methamidophos, 1.7 mg/litre for carbaryl, 0.21 mg/litre for lindane and 50 mg/litre for diquat. The acetylcholinesterase (AChE) and carboxylesterase (CarE) activities of the brain and liver were monitored over six weeks in fish poisoned with sublethal doses of methamidophos. Brain CarE was more sensitive than AChE, but for the liver the reverse was true. In either case the degree of enzyme inhibition increased with increasing insecticide concentrations in the water. After exposure to methamidophos at 20 mg/litre for 48 h liver AChE and CarE recovered faster than those of the brain. For both organs CarE recovered faster than AChE. At sublethal doses methamidophos affected the growth rate of the fish but no direct relationship between growth and insecticide concentrations could be established. (Deal-EIS)
W79-07607

CHRONIC LEAD POISONING IN A HERD OF MUTE SWANS,
MAFF Veterinary Investigation Centre, Loughborough (England).
V. R. Simpson, A. E. Hunt, and M. C. French.
Environmental Pollution, Vol. 18, p 187-202, 1979. 10 fig, 4 tab, 17 ref.

Descriptors: *Lead, *Toxicity, *Mute Swan, *Mortality, *Tissue analysis, *Bioaccumulation, *Anemia, Swans, Waterfowl, Poisons, Heavy metals, Iron, Zinc, Animal pathology, Animal physiology, Path of pollutants, Chemical analysis, Weight.

Lead poisoning due to the ingestion of lead fishing shot was shown to be the cause of death of a number of mute swans Cygnus olor. The area in which they were feeding was shown to be heavily contaminated with fishing shot. The results of clinical, histopathological, haematological and analytical examinations are reported. The kidneys of the dead birds contained from 350 to 6650 micrograms/g DM of lead and blood lead levels in the remainder of the herd were greatly elevated, rising to 3290 micrograms/100ml. Consistently elevated liver levels of iron and zinc and a marked loss of body weight were all directly proportional to the increase in kidney lead concentration. (Deal-EIS)
W79-07608

METAL CONTENTS OF THE TWO MARINE ALGAE FOUND ON IRON ORE TAILINGS,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W79-07609

LETHAL AND SUBLETHAL EFFECTS OF BINARY MIXTURES OF CYANIDE AND HEXAVALENT CHROMIUM, ZINC, OR AMMONIA TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS) AND RAINBOW TROUT (SALMO GAIRDNERI),
Minnesota, Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
S. J. Broderius, and L. L. Smith, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 164-172, 1979. 1 fig, 2 tab, 31 ref.

Descriptors: *Toxicity, *Minnows, *Rainbow trout, *Chemical properties, *Cyanide, Zinc, Chromium, Bioassay, Mortality, Ammonia, Fish physiology, Growth rates, Chemical reactions, Mathematical models, Juvenile growth stage.

Various models have been proposed to predict the combined interactive effect on fish of mixtures of poisons from separate toxicities of individual substances. The success of these models was tested, using data describing the lethal and sublethal effects of individual substances or binary mixtures of HCN and Cr(VI), Zn(II), or ammonia to the fathead minnow and rainbow trout. Using the strictly additive toxic unit and additive index approach, it was determined from log-dosage mortality curves that the Zn-HCN and ammonia-HCN mixtures were more acutely toxic and Cr-HCN less toxic than predicted. The concentration and response addition models, which have been proposed for toxicants whose joint action is similar or independent, respectively, could not be used to predict dosage-mortality curves for the HCN mixtures. Linear regression lines representing the growth response of fish to log concentration for toxicants alone and in binary combinations were not significantly different, thus, for the toxic substances tested, the sublethal joint action of individual toxicants was not predictable from existing models and, in most cases, no interaction was indicated. The interactive nature of toxicants may be a function of the concentrations tested causing different biological processes to be affected (e.g. mortality vs. growth), and therefore different responses to be measured. A need still exists for development of a valid multiple toxicity approach for evaluating and predicting the toxicity of chemical combinations. (Deal-EIS)
W79-07610

EFFECT OF PHENOBARBITAL AND HEXOBARBITAL TREATMENT ON LEPIDOCEPHALICHTHYS THERMALIS, A FRESH WATER FISH,
Marathwada Univ., Aurangabad (India). Dept. of Chemistry.
M. S. Kachole, S. S. Pawar, and A. G. Mahajan.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p. 488-491, 1979. 1 fig, 12 ref.

Descriptors: *Tissue analysis, *Acetylcholinesterase, *Phenobarbital, *Hexabarbital, *Lepidocephalichthys, Freshwater fish, Fish physiology, Animal metabolism, Oxygen, Proteins, Lipids, Organic compounds, Absorption.

L. thermalis were exposed to 1 ppm of either phenobarbital or hexabarbital for seven days. Relative liver weights and liver 9,000 g protein levels were found to be concomitantly decreased. Body weight, oxygen uptake and liver lipase activity did not show any considerable differences in treated untreated fishes. Brain cholinesterase activity was found to be decreased in fishes treated with phenobarbital and hexobarbital. (Deal-EIS)
W79-07611

THE EFFECTS OF HYDROGEN CYANIDE ON ASELLUS COMMUNIS AND GAMMARUS PSEUDOLIMNAEUS AND CHANGES IN THEIR COMPETITIVE RESPONSE WHEN EXPOSED SIMULTANEOUSLY,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
D. M. Oseid, and L. L. Smith, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 439-447, 1979. 6 tab, 8 ref.

Descriptors: *Fish physiology, *Toxicity, *Dominant organisms, *Hydrogen cyanide, *Gammarus, *Asellus, Isopods, Zooplankton, Competition, Animal behavior, Bioassay, Animal reproduction, Chemical properties, Fish eggs, Chemical wastes.

In the present study, short-term tests were done on each species alone and then full-life-cycle tests were performed on each species alone and then with the two together. The 96-h LC50 for Asellus was 2,295 microgram/l HCN and for Gammarus was 169 microgram/l. The highest no-effect concentration on Asellus in the full-life-cycle test lies between 29 and 40 microgram/l. The no-effect concentration on Gammarus was between 16 and 21 microgram/l. When exposed together to low levels, the competitive advantage shifted from Gammarus to the normally passive Asellus. (Deal-EIS)
W79-07612

METHYLAMINE UPTAKE IN THE GREEN ALGA CHLORELLA PYRENOIDOSA,
Rochester Univ., NY. Dept. of Biology.
J. L. Pelley, and T. T. Bannister.
Journal of Phycology, Vol. 15, p 110-112, 1979. 1 fig, 11 ref.

Descriptors: *Absorption, *Chlorella, *Nitrogen, *Methylamine, *Penicillium, Ammonium compounds, Kinetics, Chemical properties, Chemical analysis, Enzymes, Biochemistry, Cytological studies, Nitrogen compounds.

Methylamine uptake in nitrogen-starved Chlorella pyrenoidosa follows Michaelis-Menten kinetics: maximum uptake is about 1.6 nmol/microl cells/min half-saturation occurs at 4 microM methylamine, and the slope in the range where uptake is proportional to concentration is 0.4 nmol microl/min/microM. In cells grown in the presence of a non-limiting nitrogen concentration, methylamine uptake is directly proportional to concentration up to at least 0.5 mM, and the slope is 1/500 that for starved cells. Similar uptake kinetics have been reported for Penicillium chrysogenum and attributed to an inducible 'ammonium permease'. Apparently, a similar permease occurs in algae. (Deal-EIS)
W79-07613

RELATION BETWEEN TOXICITY AND ACCUMULATION OF VARIOUS CHLOROPHENOLS IN GOLDFISH,
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5B.
W79-07614

REQUIREMENT OF RED SEA BREAM FOR DIETARY MG,
Kyushu Univ., Fukuoka (Japan). Fisheries Research Lab.
S. Sakamoto, and Y. Yone.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 45, No. 1, p 57-60, 1979. 1 fig, 5 tab, 16 ref.

Descriptors: *Magnesium, *Fish diets, *Bream, *Chrysophrys, *Tissue analysis, Aquiculture, Chemical analysis, Fish management, Growth rates, Calcium, Phosphorus, Fish diseases, Fish physiology.

Red sea bream, Chrysophrys major, were fed diets with and without supplemental magnesium (66 and 12 mg Mg per 100 g diet, respectively) over a 60-day period. No significant differences were recognized between the two groups in the following determinations: the growth rate, feed efficiency, condition factor, and hepatosomatic index; the hemoglobin content, hematocrit value, red blood cell count, mean corpuscular hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin concentration, mean corpuscular diameter, percentage of immature erythrocytes, a number of lymphocytes and granulocytes per 1000 red blood cells, and content of magnesium in the whole blood; the blood serum levels of calcium inorganic phosphorus, and urea-N; the moisture, lipid, and glycogen content of the dorsal muscle and liver; and the ash, calcium, phosphorus, and magnesium content of the vertebrae. Furthermore, no pathological change was recognized in the organs, erythrocytes, and leucocytes of fish fed the diet without the magnesium supplement. From these findings, it appears that magnesium supplementation in the diet for red sea bream is not essential, when the magnesium exists at a level exceeding 12 mg per 100 g diet. (Deal-EIS)
W79-07615

CADMIUM TOXICITY OF LABORATORY AND FIELD POPULATIONS OF DAPHNIA GALEATA MENDOTAE,
Argonne National Lab., IL. Radiological and Environmental Research Div.
J. S. Marshall.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 453-457, 1979. 1 fig, 10 ref.

Descriptors: *Cadmium, *Lethal limit, *Daphnia, Toxicity, Mortality, Heavy metals, Aquatic populations, Zooplankton, Mathematical studies, Lake Michigan, Animal physiology, Water pollution effects, Laboratory tests, On-site-investigations, Methodology.

The purpose of this paper is to report on the relationship between exposure time and cadmium toxicity to laboratory and field populations of Daphnia galeata mendotae, as summarized in a cadmium toxicity curve, and to derive a cadmium toxicity curve, and to derive a cadmium application factor. The 96-h EC50 is 30 microg Cd/L and the 48-h EC50 is 40 microg Cd/L. The long-term effects of increased cadmium concentrations on relative carrying capacity for D. galeata mendotae populations, K, is represented by the equation K = 1.0-0.065 Cd, and the corresponding chronic ECl is 0.15 microg Cd/L. (Deal-EIS)
W79-07616

STUDIES ON INTRAPERITONEAL TOXICITY OF LEAD TO CICHLASOMA NIGROFASCIATUM (GUENTHER) DEVELOPMENT,
Uppsala Univ. (Sweden). Inst. of Zoology.
P. T. E. Ozoh.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 676-682, 1979. 2 tab, 27 ref.

Descriptors: *Lead, *Toxicity, *Cichlids, Metals, *Mutagens, *Teratogens, Fish reproduction, Fry, Larval growth stage, Mortality, Fish physiology, Spawning, Fertility, Heavy metals, Embryonic growth stage, Water pollution effects.

Zebra cichlids were exposed to several concentrations of lead (50-600ppm) via intraperitoneal injections. Lead affected ovulation and its frequency. All the doses were more toxic to females, which experienced ovulation stresses, loss of muscular coordination and balance, irregular swimming bouts, swollen stomachs and finally falling to the bottom followed by death. In the Zebra cichlids that out-lived lead toxicity, spermatogenesis and oorgenesis occurred up to 300 ppm. Lead affected the survival of the fry. Lead also induced a number of lethal and non-lethal congenital malformations in the fry. (Deal-EIS)
W79-07617

CHEMICAL CONTAMINATION BY PCBS IN THE FISHES OF A FRENCH RIVER: THE FURANS (JURA),
Ecole Nationale Veterinarie de Lyon (France). Lab. of Toxicology.
G. Keck, and J. Raffenot.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 689-696, 1979. 5 fig, 1 tab, 8 ref.

Descriptors: *Polychlorinated biphenyls, *Brown trout, *Bullheads, *Pesticide residues, *Tissue analysis, *Bioaccumulation, *Furans River(France), *Cyprinids, PCB, Salmonids, Chlorinated hydrocarbon pesticides, Pesticide kinetics, Path of pollutants, DDT, Size, Weight, Lipids, Chemical analysis, Water pollution effects.

Representative species of the fish population of the Furans River were analyzed for PCB content. The levels of PCBs found in the fishes were relatively high, much higher than the levels of organochlorine pesticides. The most striking fact is the high degree of accumulation by the barbel and the cub (Cyprinids) in comparison with the Salmonids, trout and grayling. The distribution of PCBs between the organs varies according to the species; the liver always concentrates most; the gills and the eggs also contain high concentrations; the levels in the kidney and the muscle vary with the species. (Deal-EIS)
W79-07618

TRENDS IN APPLIED PHYCOLOGY WITH A LITERATURE REVIEW: SEAWEED FARMING ON AN INDUSTRIAL SITE,
Department of Marine Botany, Goteborg (Sweden).
For primary bibliographic entry see Field 5B.
W79-07619

COMPARISON OF TOXINS IN THREE ISOLATES OF GONYAULAX TAMARENSIS (DINOPHYCEAE),
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5A.
W79-07620

TOXICITY AND BIOACCUMULATION OF HEXACHLOROCYLOPENTADIENE HEXACHLORONORBORNADIENE AND HEPTACHLORONORBORNENE IN LARVAL AND EARLY JUVENILE FATHEAD MINNOWS, PIMEPHALES PROMELAS,
Environmental Research Lab., Duluth, MN.
R. L. Spehar, G. D. Veith, D. L. DeFoe, and B. V. Bergstedt.
Bulletin of Environmental Contamination and Toxicolog,, Vol. 21, p 576-583, 1979. 3 tab, 21 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Toxicity, *Minnows, *Tissue analysis, *Bioaccumulation, *Cyclodiene insecticides, Hexachlorocyclopentadiene, Pesticide toxicity, Pesticide kinetics, Chemical analysis, Chemical reactions, Chemical properties, Insecticides, Bioassay, Mortality, Fish physiology, Larval growth stage, Juvenile growth stage.

The purpose of this study was to determine the toxicity and bioaccumulation of hexachlorocyclopentadiene and selected derivatives using 30 day flow through tests with larval and early juvenile stages of the fathead minnow. Thirty-day exposures with larval and early juvenile fathead minnows showed that concentrations of 7.3, 38.4, and 40.0 micrograms/L and above of hexachlorocyclopentadiene, hexachloronorbornadiene, and

heptachloronorbornene, respectively, would be deleterious to this species. The 96-h LC50 and 30-day LC50 values for these compounds, respectively, were: 7.0 and 6.7 micrograms/L, 188 and 123 micrograms/L, and 85.6 and 60.1 micrograms/L. Bioconcentration factors were uniformly low for hexachlorocyclopentadiene but were proportional to exposure concentration for hexachloronbornadiene and heptachloronorbornene. (Deal-EIS)
W79-07622

REMOBILIZATION OF SEDIMENT-ASSOCIATED PCBS BY THE WORM NEREIS DIVERSICOLOR,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
D. L. Elder, S. W. Fowler, and G. G. Polikarpov.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 448-452, 1979. 1 fig, 10 ref.

Descriptors: *Polychlorinated biphenyls, *Worms, *Absorption, *Bottom sediments, *Nereis, *Depuration, *Bioconcentration, *Tissue analysis, Marine benthos, Sediments, Chlorinated hydrocarbon pesticides, Path of pollutants, Chemical analysis, Organic compounds, Animal metabolism.

In order to test the existence and degree of importance of remobilization of PCBs from sediments, the polychaete Nereis diversicolor was exposed to sediment containing 0.65 ppm PCB. The worms absorbed PCBs until equilibrium was reached in 40-60 days. The concentration factors was approximately 3.5. Following transfer to uncontaminated sediments the PCB content of the worms steadily decreased. It was theorized that the depuration rate was dependent on the PCB level in the sediments. (Deal-EIS)
W79-07623

THE CHRONIC TOXICITY OF CARBARYL AND LINDANE TO THE FRESHWATER MOLUSC LYMNEA STAGNALIS L. (TOXICITE CHRONIQUE DU CARBARYL ET DU LINDANE CHEZ LE MOLLUSQUE D'EAU LYMNEA STAGNALIS L),
Paris-11 Univ., Orsay (France). Lab. de Zoologie.
J. Seuge, and R. Bluzat.
Water Research, Vol. 13, p 285-293, 1979. 4 fig, 5 tab, 20 ref. (English Abstract).

Descriptors: *Toxicity, *Insecticides, *Mollusks, *Lindane, Carbaryl, *Lymnea, *Embryogenesis, Freshwater snails, Growth rates, Larval growth state, Animal physiology, Animal metabolism, Fecundity, Fertility, Pesticide toxicity, Carbamate pesticides, Chlorinated hydrocarbon pesticides.

The chronic toxicity of the two insecticides to snails was studied from the hatching of the eggs. In the case of lindane, the rearing of larvae is impossible beyond a 2 mg/l concentration. With these two toxic products (1 or 2 mg/l) the shell growth is reduced in proportion to the doses. The shell calcification is clearly disturbed only by lindane. This product (1 mg/l) produces a decrease of the fecundity more evident than carbaryl (2 mg/l). The fertility of the eggs is reduced when they are laid and incubated in these toxic solutions from the 2 mg/l concentration. The embryogenesis is disturbed by lindane. An early intoxication by these two insecticides, compared with a late one, affects the biological parameters more severely. (Deal-EIS)
W79-07624

BIOCONCENTRATION OF CHLORDANE BY THE GREEN ALGA SCENEDESMUS QUADRICAUDA,
Toronto Univ. (Ontario). Faculty of Forestry.
V. Glooschenko, M. Holdrinet, J. N. A. Lott, and R. Frank.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 515-520, 1979. 1 tab, 20 ref.

Descriptors: *Scenedesmus, *Chlorinated hydrocarbon pesticides, *Chlordane, *Bioconcentration, Chlorophyta, Pesticide kinetics, Path of pollutants, Metabolism, Phytoplankton, Organic compounds, Chemical analysis, Aquatic algae, Biodegradation.

Results show a bioconcentration factor of 6,000 to 15,000 for cis and trans chlordane at all treatment levels after 24 hr. This is in contrast to a bioconcentration factor of 98,000 observed in the unbranched filamentous algal Oedogonium. The greater algal biomass represented by Oedogonium may have contributed to increased pesticide uptake. Our work shows the major isomers of technical chlordane are concentrated by Scenedesmus from initial environmental levels as low as 0.1 micrograms/L. The 0.1 micrograms/L level is approximately 1/100 of the water solubility of technical chlordane. The data indicate that bioconcentration was rapid, occurring within the first 24 hr. (Deal-EIS)
W79-07625

ORGANOPHOSPHATE POISONING TO SOME FRESH WATER TELEOSTS - ACETYLCHOLINESTERASE INHIBITION,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, A. K. Tyagi, M. C. Bhatnagar, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 502-506, 1979. 2 tab, 14 ref.

Descriptors: *Organophosphorus pesticides, *Pesticide toxicity, *Enzymes, *Acetylcholinesterase, *Tissue analysis, *Channa, *Cirrhina, *Malathion, Biochemistry, Chemical analysis, Insecticides, Freshwater fish, Fish physiology, Animal metabolism, Mortality, Inhibition, Water pollution effects.

The activity of AChE in the brain, liver and muscles of Channa gachua and Cirrhina mrigala was determined after exposure of fishes to sublethal concentrations of Zolone, Rogor and Malathion. A significant fall in the AChE activity has been observed after treatment in both the fishes. A progressive significant fall in the enzyme activity has been observed in all tissues with increased pesticide concentrations. The highest fall in the activity of this enzyme was observed in brain of C. mrigala after three days exposure to Malathion, while least in liver of C. gachua exposed for seven days in Rogor. (Deal-EIS)
W79-07626

EFFECT OF INTERMITTENT CHLORINATION ON DEVELOPING ZEBRAFISH EMBRYOS (BRACHYDANIO RERIO),
Florida Inst. of Tech., Melbourne. Dept. of Biological Sciences.
S. F. Yosha, and G. M. Cohen.
Bulletin of Environmental Contamination and Toxicology, Vol. 121, p 703-710, 1979. 3 fig, 3 tab, 24 ref.

Descriptors: *Chlorine, *Toxicity, *Embryonic growth stage, *Chlorination, *Zebrafish, Larval growth stage, Mortality, Ions, Calcium, Magnesium, Chlorides, Fish eggs, Fish physiology, Water quality, Water pollution effects.

The primary objective was to determine whether chlorine adversely affects the hatchability of freshwater fish embryos and to what extent, if any, chlorine toxicity is modified by the ionic composition of the water. Contrary to initial expectations, chlorine, even at a relatively high concentration (1 mg/mL total residual chlorine), was not toxic to developing zebrafish embryos prior to hatching. However, chlorine in the presence of a mild external ionic stress (CaCl2 and MgCl2) significantly reduced the number of embryos hatched. Chlorine was toxic to newly hatched larvae in all solutions tested, whereas no mortalities of the newly hatched larvae occurred in any of the solutions in the absence of chlorine. Once again ionic stress potentiated the effects of chlorine. (Deal-EIS)
W79-07627

VESSEL-RELATED CONTAMINATION OF SOUTHERN CALIFORNIA HARBOURS BY COPPER AND OTHER METALS,
Southern California Coastal Water Research Project El Segundo.
D. R. Young, G. V. Alexander, and D. McDermott-Ehrlich.
Marine Pollution Bulletin, Vol. 10, p 50-56, 1979. 3 fig, 5 tab, 19 ref.

Descriptors: *Mussels, *Copper, *Paints, *Antifouling materials, *Tissue analysis, *Mytilus, Chemical analysis, Polychlorinated biphenyls, Silver, Cadmium, Chromium, Nickel, Lead, Tin, Zinc, Ships, Water pollution sources, Bioindicator.

A number of trace contaminants appear to be introduced to nearshore marine waters as a result of vessel-related activities. Such inputs are clearly reflected by elevated concentrations of these constituents in several tissues of the bay mussel Mytilus edulis. Comparative studies using this bioindicator suggest that harbour-related activities can be as important a source as coastal wastewater discharges in the contamination of nearshore marine ecosystems. (Deal-EIS)
W79-07628

TEMPERATURE SELECTION AND ESTIMATED THERMAL ACCLIMATION BY RAINBOW TROUT (SALMO GAIRDNERI) IN A THERMAL PLUME,
Argonne National Lab., IL.
S. A. Spigarelli, and M. M. Thommes.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 366-376, 1979. 5 fig, 3 tab, 38 ref.

Descriptors: *Rainbow trout, *Thermal pollution, *Water temperature, Heated water, Fish physiology, Animal metabolism, Adaptation, Size, Weight, Fish behavior, Lake Michigan, Nuclear powerplants, Cooling water, Water pollution effects.

Body temperatures of rainbow trout caught from a thermal discharge into Lake Michigan were used to determine selected temperatures and to estimate acclimation temperatures of this species under field conditions. Approximately 65-75% of the variability in body temperatures was related to water temperature (direct) and fish weight (inverse). Body temperatures increased with increases in discharge temperature, but the difference between body and ambient water temperatures decreased at high water temperatures. The modal body temperature of small fish was 19 degrees C, the final preferred temperature predicted for rainbow trout by some lab studies. The modal body temperature of large fish was 15 degrees C. Estimates of acclimation temperatures indicate that the majority of rainbow trout caught in this discharge area were acclimated to plume temperatures. Estimated acclimation temperatures exceeded ambient acclimation by as much as 10 degrees C for individual fish while group means ranged between 2 and 6 degrees C for individual fish while group means ranged from 2 and 6 degrees C over acclimation. (Deal-EIS)
W79-07629

PCBS AND ORGANOCHLORINE INSECTICIDES IN OYSTERS FROM COASTAL LAGOONS OF THE GULF OF MEXICO, MEXICO,
Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Ciencias del Mar y Limnologia.
M. T. Rosales, L. A. V. Botello, H. Bravo, and E. F. Mandell.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 652-656, 1979. 1 fig, 2 tab, 6 ref.

Descriptors: *DDT, *Polychlorinated biphenyls, *Oysters, *Pesticide residues, *Tissue analysis, *Crassostrea, *Chlordane, *Endosulfan, *Bioaccumulation, Dieldrin, Chlorinated hydrocarbon pesticides, Endrin, Gulf of Mexico, Lagoons, Coastal waters, Path of pollutants, Pesticide kinetics.

The purpose of this study was to determine baseline levels of PCBs and organochlorine insecticides in oysters (Crassostrea virginica) from coastal lagoons of the Gulf of Mexico. PCBs were found in all samples analyzed, indicating that these compounds are widely distributed. The concentration of PCBs ranged from 14 to 90 ppb, with the lowest

values from very sparcely populated areas. DDT and dieldrin were present in most of the oysters analyzed, other organochlorine compounds were infrequently detected or found at low levels. DDT, with its analogs, occurred in concentrations ranging from 6 to 28 ppb. Dieldrin concentrations ranged from 0.03 to 1.1 ppb. (Deal-EIS)
W79-07630

EFFECT OF PH ON TOXICITY OF KRAFT PULP AND PAPER MILL EFFLUENT TO SALMONID FISH IN FRESH AND SEAWATER,
British Columbia Research Council, Vancouver. Div. of Applied. Biology.
D. J. McLeay, C. C. Walden, and J. R. Munro.
Water Research, Vol. 13, p 249-254, 1979. 2 fig, 2 tab, 29 ref.

Descriptors: *Pulp wastes, *Hydrogen ion concentration, *Toxicity, *Acclimation, Bioassays, Rainbow trout, Coho salmon, Chemical wastes, Industrial wastes, Fish physiology, Mortality, Bleaching wastes, Juvenile growth stage, Salmonids, Water pollution effects.

In freshwater bioassays with juvenile rainbow trout at initial pH values from 4 to 11, kraft mill effluents were considerably less toxic at pH 9-10 than at neutrality. When pH of test solutions was controlled throughout the bioassay period, the least toxic range was 8.5-9.5. Toxicity at typical receiving-water pH values was 50-67% greater. The acute toxicity of effluent samples to yearling coho salmon was identical for these effluents in seawater and freshwater respectively, provided that the pH was adjusted and held at the same value, and that test fish were previously acclimated to the dilution water for several months. Thus seawater constituents other than pH did not affect the acute toxicity of pulp and paper mill effluents appreciably. (Deal-EIS)
W79-07632

EFFECT OF UPGRADING A MUNICIPAL WASTEWATER EFFLUENT ON POLLUTION INDICATOR AND OTHER MICROORGANISMS IN RIVER WATER,
Connecticut Univ., Noank. Marine Research Lab.
E. A. Matson, S. G. Hornor, and J. D. Buck.
Environmental Science and Technology, Vol. 13, No. 4, p 460-465, 1979. 5 fig, 6 tab, 48 ref.

Descriptors: *Coliforms, *Enteric bacteria, *Sewage bacteria, *Sewage treatment, Chlorination, Bacteria, Water quality, Water quality control, Primary treatment, Secondary treatment, Municipal wastes, Activated sludge, Waste treatment, Streptococcus, Yeasts, Biochemical oxygen demand.

Densities of total and fecal coliforms, fecal streptococci, plate count bacteria, and certain yeasts were monitored in an eastern Connecticut watershed for 1 year prior to upgrading a municipal primary settling treatment plant to activated sludge. Sampling was continued for 19 months afterward. Substantial reductions in densities of indicator and other bacteria and yeast upstream of the effluent after upgrading were associated with lower annual precipitation and reduced precipitation-associated sampling. The effluent dilution decreased from 0.84 to 1.42% of river volume due to increased daily treatment plant discharge and decreased river discharge. Calculated reductions in effluent discharge of indicators ranged from 10% (total coliforms) to 84% (fecal coliforms), while the discharge of 'total plate count bacteria' increased 500%. Chlorination procedures were still required to reduce river total coliform densities below the accepted limit. Within the microbiological perspective, upgrading this treatment plant was of limited value to potential water users. (Deal-EIS)
W79-07633

EFFECTS OF VARIOUS TEMPERATURE CYCLES ON THE LARVAL DEVELOPMENT OF THE GASTROPOD MOLLUSC CREPIDULA FORNICATA,
Duke Univ., Beaufort, NC. Marine Lab.
J. S. Lucas, and J. D. Costlow, Jr.
Marine Biology, Vol. 51, p 111-117, 1979. 3 fig, 3 tab, 12 ref.

Descriptors: *Water temperature, *Gastropods, *Thermoperiodism, *Tissue analysis, Inhibition, Growth rates, Larval growth stage, Mollusks, Cycles, Period of growth, Biorhythms, Animal physiology, Animal metabolism, Thermal pollution.

Veligers of Crepidula fornicata (L.) were reared for 12 days at constant temperatures of 15, 20, 25, 30 and 35 degrees C, and at 5 degrees C daily cycles of equal periodicity (COEP) over the temperature ranges 15 to 20 degrees C, 20 to 25 degrees C, 25 to 30 degrees C and 30 to 35 degrees C. COEP consisted of equal periods (6 h) of maximum temperature, minimum temperature, and uniformly increasing and decreasing temperature each 24 h period. Survival was high and not influenced by cyclic or constant temperature from 15 to 30 degrees C. At 35 degrees C and COEP 30 to 35 degrees C, all larvae died before day 6. Shell growth rate increased markedly over the range 15 to 25 degrees C, and growth rates at cyclic temperatures in this range were intermediate between growth rates at the corresponding constant temperatures. Larvae reared at COEP 15 to 20 degrees C and COEP 30 to 35 degrees C had discontinuities in their shells due to inhibition of shell secretion during the adverse part of each temperature cycle. Groups of C. fornicata veligers were exposed for 2 days to daily temperature cycles of equal and unequal periodicity in their critical 30 to 35 degrees C range. These veligers showed shell growth although their body tissue declined, as indicated by decreasing carbon content per larva. Least shell growth and most body tissue loss occurred in those cycles with the longest exposure to higher temperature. Rates of shell growth of veligers in temperature cycles show an immediate effect of environmental temperature, while changes in carbon content per larva better reflect the effects of temperature on general metabolism and survival. (Deal-EIS)
W79-07634

INTERACTIVE EFFECTS OF SALINITY, TEMPERATURE AND CHRONIC EXPOSURE TO OIL ON THE SURVIVAL AND DEVELOPMENTAL RATE OF EMBRYOS OF THE ESTUARINE KILLIFISH FUNDULUS HETEROCLITUS,
Texas A and M Univ., College Station. Dept. of Biology.
O. Linden, J. R. Sharp, R. Laughlin, Jr., and J. M. Neff.
Marine Biology, Vol. 51, p 101-109, 1979. 4 fig, 3 tab, 33 ref.

Descriptors: *Killifishes, *Toxicity, *Oil, *Salinity, *Water temperature, *Naphthalenes, *Water soluble fraction, Embryonic growth stage, Growth stages, Growth rates, Oil pollution, Mortality, Organic compounds, Aromatic compounds, Thermal stress, Salt tolerance.

The combined effect of salinity, temperature and chronic exposure to water-soluble fractions (WSF) of a No. 2 fuel oil on the survival and development rate of embryos of Fundulus heteroclitus are described. The embryos were exposed at 3 salinities (10, 20, 30% S) and 3 temperatures (20, 25, 30 degrees C) to 3 different oil concentrations (15, 20, 25% WSF, equivalent to approx 0.28, 0.38 and 0.47 ppm total naphthalens) and to one control without oil. The results were analyzed by response-surface methodology. The lowest oil concentration was only mildly toxic to embryos under optimal salinity/temperature conditions, while the highest was extremely toxic in all factor combinations. Under optimal conditions, only the highest oil concentration resulted in more than 50% mortality. Under sub-optimal conditions, especially high and low temperatures, all 3 oil concentrations caused greater than 50% mortality. The interactive effect of salinity and temperature on survival was greatest at the lowest oil concentration. Temperature had a marked effect and salinity only a slight effect on the developmental rate of the embryos. Exposure to the low oil concentration tended to increase the temperature sensitivity of developmental duration slightly. Generally, exposure to oil decreased the time interval between fertilization and hatching. (Deal-EIS)
W79-07635

ENVIRONMENTAL DISTURBANCE AND LIFE HISTORIES: PRINCIPLES AND EXAMPLES,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
D. M. Lehmkuhl.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 329-334, 1979. 2 tab, 45 ref.

Descriptors: *Environment, *Environmental effects, *Water pollution effects, *Freshwater organisms, Aquatic organisms, Benthos, Heavy metals, Nutrients, Hydrogen ion concentration, Dissolved solids, Toxicity, Water temperature, Food chain, Heavy metals, Herbicides, Pesticides, Aquatic insects, Watershed.

While many environmental disturbances have no readily detectable effect on aquatic invertebrates in the short term, they may prevent normal reproduction and cause eventual local extinction of a species. Small temperature changes may interfere with diapause signals and prevent completion of the life cycle. Heavy metals and toxic substances may drastically reduce reproduction rates in species exposed to sublethal levels. Dissolved salts and pH affect organisms at abnormally high or low levels but most mechanisms are unknown. It is concluded that relatively little information is available on the effects of environmental disturbances on life cycles. Available information, however, is sufficient to provide evidence of many problems that require attention. (Katz-EIS)
W79-07636

EFFECTS OF TEMPERATURE ON THE MEDIAN TOLERANCE LIMIT OF PINK SALMON AND SHRIMP EXPOSED TO TOLUENE, NAPHTHALENE, AND COOK INLET CRUDE OIL,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
S. Korn, D. A. Moles, and S. D. Rice.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 521-525, 1979. 2 tab, 8 ref.

Descriptors: *Water temperature, *Oil spills, *Toxicity, *Pink salmon, *Shrimp, *Crude oil, *Naphthalenes, *Toluene, Oil, Oil pollution, Organic compounds, Aromatic compounds, Lethal limit, Mortality, Fish physiology, Animal physiology, Bioassay, Animal metabolism, Water pollution effects.

The concentration of toxicants in the test containers declined with time, from either evaporation losses or biodegradation, with more rapid losses occurring at higher temperatures. The 96-h TLm of pink salmon fry exposed to toluene was significantly lower at 4 degrees (6.41 ppm) than at 12 degrees C (8.09 ppm). The trend toward lower TLm's at lower temperatures was observed for the Cook Inlet crude oil WSF, but the differences were not statistically significant. The 96-h TLm' for shrimp exposed to toluene and naphthalene solutions were significantly higher at 4 degrees C (toluene = 21.4 ppm, naphthalene = 2.16 ppm) than at 12 degrees (toluene = 14.7 ppm, naphthalene = 0.97 ppm). Temperature did not affect the TLm of shrimp to the Cook Inlet crude oil WSF. (Deal-EIS)
W79-07637

RESIDUAL HEAVY METAL REMOVAL BY AN ALGAE-INTERMITTENT SAND FILTRATION SYSTEM,
Utah Water Research Lab., Logan.
D. S. Filip, T. Peters, V. D. Adams, and E. J. Middlebrooks.
Water Research, Vol. 13, p 305-313, 1979. 7 fig, 4 tab, 17 ref.

Descriptors: *Heavy metals, *Algae, *Waste water treatment, *Filtration, *Bioaccumulation, *Tissue analysis, *Oscillatoria, Chromium, Cadmium, Copper, Toxicity, Absorption, Biological treat-

nent, Phytoplankton, Chemical wastes, Growth rates, Scenedesmus, Chlorella.

A laboratory scale study was undertaken to determine the feasibility of using algae growing in wastewater lagoons to absorb residual heavy metals for subsequent complete removal by intermittent sand filtration of the metal laden algae. In semi-continuous cultures the mixed algal flora native to wastewater lagoons absorbed 70-90% of the cadmium and copper from the wastewater media. Chromium absorption was less by ratio (20% was absorbed), but the mass of chromium removed was much greater as high levels of chromium were added. Only one alga (Oscillatoria sp.) which was extremely resistant to chromium grew in the chromium exposed cultures. Nearly total removal of the cadmium and copper was achieved by the algae-intermittent sand filter system. The net chromium removal agreed with the accumulation analyses. The technical feasibility of removing certain heavy metals from wastewater with such a system was established. However, in depth laboratory and field studies must be conducted to maximize system efficiency, demonstrate tactical limitations, and establish design specifications. (Deal-EIS)
W79-07638

THE EFFECT OF TEMPERATURE ON THE TOXICITY OF CHLORINATED COOLING WATERS TO MARINE ANIMALS-A PRELIMINARY REVIEW,
Woods Hole Oceanographic Institution, MA.
J. M. Capuzzo.
Marine Pollution Bulletin, Vol. 10, p 45-47, 1979. 1 tab, 14 ref.

Descriptors: *Water temperature, *Toxicity, *Chlorine, *Chloramine, *Acartia, *Brachionus, *Homarus, Cooling water, Animal physiology, Halogens, Absorption, Thermal pollution, Thermal stress, Bioassay, Mortality, Oysters, Chlorination, Killifishes, Lobsters, Pink salmon, Chinook salmon, Powerplants.

The effect of temperature on the toxicity of free chlorine and chloramine to several species of marine animals is reviewed. For all species tested, except the copepod Acartia tonsa, temperature has a synergistic effect on the toxicity of both halogen forms. It is suggested that the effect of temperature in enhancing the toxic effects of chlorinated cooling waters to marine animals is due to an interaction of uptake rates and regulation of physiological rates and the greatest enhancement in sensitivity could be expected at the upper limit of a species' thermal tolerance. (Deal-EIS)
W79-07639

RESISTANCE OF BACTERIAL CHEMOTAXIS TO BLOCKAGE IN PETROLEUM WATERS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
G. Bitton, D. A. Chuckran, I. Chet, and R. Mitchell.
Marine Pollution Bulletin, Vol. 10, p 48-49, 1979. 4 tab, 10 ref.

Descriptors: *Pseudomonas, *Oil, *Microbial degradation, *E coli, *Kerosene, *Chemotaxis, *Chemoreceptors, Marine bacteria, Organic compounds, Animal behavior, Biodegradation, Aquatic bacteria, Coliforms, Aerobic bacteria, Oil spills, Oil pollution.

Bacterial chemotaxis is normally inhibited by hydrocarbons. In this experiment E. coli and Pseudomonas sp. were cultured in 5 different concentrations of kerosene. We have found that the chemotactic response of motile hydrocarbon degrading bacteria living in water that has been polluted with oil is unaffected by petroleum hydrocarbons. (Deal-EIS)
W79-07641

CALANOID COPEPOD EGGS IN SEA-BOTTOM MUDS. IV. EFFECTS OF SOME ENVIRONMENTAL FACTORS ON THE HATCHING OF RESTING EGGS,
Hiroshima Univ. (Japan). Faculty of Fisheries and Animal Husbandry.
For primary bibliographic entry see Field 5B.
W79-07642

ACUTE TOXICITY OF PLATINUM TO COHO SALMON (ONCORHYNCHUS KISUTCH),
Normandeau Associates, Bedford, NH.
P. F. Ferreira, Jr., and R. E. Wolke.
Marine Pollution Bulletin, Vol. 10, p 79-83, 1979. 4 fig, 1 tab, 17 ref.

Descriptors: *Toxicity, *Bioassay, *Sockeye salmon, *Platinum, *Survival, *Tissue analysis, Mortality, Fish behavior, Fry, Fish physiology, Animal metabolism, Growth rates, Animal pathology, Metals.

The effects of short-term exposure to tetravalent platinum on survival, opercular movement and post-treatment growth of coho salmon fry was investigated. Employing a static water acute toxicity bioassay with platinum as (PtCl42HCl.6H2), at 8.5 + or - 0.2 degrees C, and a water hardness of 55.9 + or - 3.5 mg/l. (as CaCo3), the 24, 48, and 96-h LC50 values were 15.5, 15.2, and 2.5 mg Pt4+/l respectively. Rates of opercular movement for fish exposed to platinum increased with increasing concentrations to a level of 1.0 mg/l. No further significant increases were evident above this level. Hypoactivity of fish exposed to 0.3 mg/l and higher was evident during the acute toxicity bioassay and much of the post-treatment study. Post-treatment rate of growth for fish exposed to sublethal concentration of platinum for 96 h was less than that of the controls. (Deal-EIS)
W79-07644

MODIFICATION OF THE RHEOTROPIC RESPONSE OF RAINBOW TROUT (SALMO GAIRDNERI) BY SUBLETHAL DOSES OF THE AQUATIC HERBICIDES DIQUAT AND SIMAZINE,
Waterloo Univ. (Ontario). Dept. of Biology.
J. J. Dodson, and C. I. Mayfield.
Environmental Pollution, Vol. 18, p 147-157, 1979. 1 fig, 9 tab, 17 ref.

Descriptors: *Rainbow trout, *Pesticide toxicity, *Fish behavior, *Rheotropism, *Tissue analysis, *Bioaccumulation, *Simazine, Herbicides, Diquat, Absorption, Bioassay, Fish physiology, Currents(Water), Chemical analysis, Pesticide residues, Pesticide kinetics, Path of pollutants.

The rheotaxis and swimming speeds of rainbow trout in response to a water current simulated by moving a striped background past the fish were observed following 24-h exposures to field application concentrations of the herbicides diquat, simazine and their commercial formulations. Fish tissues were subsequently analysed to assess the extent of uptake of the herbicides. Toxicological modification of rheotaxis and swimming speeds was observed in fish exposed to diquat and its formulation Reglone AR resulting in an increased incidence of downstream drift. Simazine residues in fish increased in proportion to treatment levels whereas diquat residues in fish levelled off with increasing treatment levels. The toxicological modification of rheotropism is presented as a sensitive bioassay to assess sublethal effects of biocides. (Deal-EIS)
W79-07645

UPTAKE AND LOSS OF ZINC AND LEAD BY MUSSELS (MYTILUS EDULIS) AND RELATIONSHIPS WITH BODY WEIGHT AND REPRODUCTIVE CYCLE,
Australian Atomic Energy Commission Research Establishment, Lucas Heights. Environmental Biology Section.
R. D. Simpson.
Marine Pollution Bulletin, Vol. 10, p 74-78, 1979. 4 fig, 3 tab, 21 ref.

Descriptors: *Zinc, *Lead, *Mussels, *Absorption, *Tissue analysis, *Bioaccumulation, *Mytilus, Chemical analysis, Animal physiology, Size, Animal metabolism, Heavy metals, Biorhythms, Reproduction, Growth stages, Cycles, England.

The uptake and loss of zinc and lead from the whole soft parts of the mussel Mytilus edulis were investigated under natural conditions in north-east England. Mussels in which high concentrations of these metals were found were transferred to an area where low concentrations were found, and vice versa. Mussels from both areas were also kept in tanks and periodic measurements of metal contents were made. Indications of uptake and loss were greatly affected by changing body weights and the work suggests that phase of reproductive cycle (for animals in the environment) and condition (for animals in tanks) have to be closely considered when reporting on levels of metals in mussels, especially in terms of concentration. (Deal-EIS)
W79-07646

SOME EFFECTS OF SUB-LETHAL CONCENTRATIONS OF COPPER ON A MARINE COPEPOD,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, and G. Verriopoulos.
Marine Pollution Bulletin, Vol. 10, p 88-92, 1979. 3 fig, 1 tab, 31 ref.

Descriptors: *Copper, *Toxicity, *Copepods, *Acartia, Animal behavior, Animal physiology, Animal metabolism, Fecundity, Food habits, Feeding rates, Respiration, Oxygen requirements, Adaptation, Plankton, Heavy metals, Mortality.

Laboratory experiments were carried out to determine the influence of different concentrations of copper in feeding and respiratory rates, fecundity and longevity of the marine planktonic copepod Acartia clausi, taken from a polluted and a clean area of the Saronic gulf (Greece). In the range of copper concentrations 0.001 to 0.01 mg 1.-1, all tested activities of the animals coming from the clean region seemed affected. Feeding activity, longevity and fecundity showed a progressive reduction from 0.001 to 0.001 to 0.01 mg 1.-1. The pollution-adapted population of Acartia seemed more resistant to sub-lethal copper stress. Longevity and respiration were affected in all concentrations used. The fecundity of the pollution-adapted population was higher than that of the clean area, showing a slight increase at 0.001 and 0.0025 mg 1.-1 dropping to the control animals fecundity level at 0.01 mg 1.-1. (Deal-EIS)
W79-07647

STRONTIUM, CALCIUM AND MAGNESIUM CONTENTS OF SOME MARINE ALGAE FROM THE WEST COAST OF INDIA,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
S. S. Gogate, S. M. Shah, and C. K. Unni.
Journal of the Marine Biological Association of India, Vol. 17, No. 1, p 28-33, 1975. 3 tab, 20 ref.

Descriptors: *Absorption, *Marine algae, *Strontium, *Calcium, *Magnesium, *Bioaccumulation, *Tissue analysis, *India, Phaeophyta, Chlorophyta, Rhodophyta, Chemical analysis, Radioisotopes, Metabolism.

As part of programme of work on marine radioactivity in the aquatic environment a few samples of algae were collected from the west coast of India and analysed for strontium, calcium and magnesium contents. Strontium to calcium atom ratio in brown algae was found to vary from .0216 to .0295 while in green and red algae it varied from .0051 to .0091 and .0049 to .0056 respectively. Brown algae accumulated strontium in preference to calcium from sea water. All species were shown to concentrate strontium, calcium and magnesium to some extent. (Deal-EIS)
W79-07648

THE EFFECT OF TEMPERATURE ON GROWTH, PHYSIOLOGY, AND GAMETOGENESIS IN THE MANILA CLAM TAPES PHILIPPINARUM (ADAMS & REEVE, 1850),
Woods Hole Oceanographic Institution, MA.
R. Mann.

Journal of Experimental Marine Biology and Ecology, Vol. 38, p 121-133, 1979. 1 fig, 4 tab, 22 ref.

Descriptors: *Clams, *Water temperature, *Tissue analysis, *Histology, *Gametogenesis, Ammonia, Animal metabolism, Animal physiology, Biochemistry, Reproduction, Growth rates, Carbohydrates, Mollusks, Water pollution effects.

Populations of the Manila clam were maintained at temperatures of 12, 15, 18, and 21 degrees C for a period of 19 weeks. Regular determinations were made of ammonia excretion rate following which animals were sacrificed for estimation of dry meat weight, dry shell weight, biochemical composition, and gonadal development. T. philippinarum increased from an initial dry meat weight of 291.5 mg to final values of 957.9, 733.0, 735.0, and 586.0 mg at 12, 15, 18, and 21 degrees C, respectively. An initial increase in percentage carbohydrate content was evident at all temperatures. This was followed by carbohydrate depletion associated with gametogenesis, the transition from accumulation to depletion occurring earlier with increasing temperature. Ripe gonadal material was evident at all temperatures, but spawning was only evident at 15, 18, and 21 degrees C. Ammonia excretion at 12, 15, and 18 degrees C showed an allometric relationship to meat weight; this was not so at 21 degrees C. (Deal-EIS)
W79-07650

BACTERIAL STREAMER GROWTH IN A DISUSED PYRITE MINE,
University Coll. of North Wales, Bangor. Dept. of Biochemistry and Soil Science.
D. B. Johnson, W. I. Kelso, and D. A. Jenkins.
Environmental Pollution, Vol. 18, p 107-118, 1979. 5 fig, 3 tab, 22 ref.

Descriptors: *Acid mine water, *Acid streams, *Thiobacillus ferrooxidans, Acidic water, Mine drainage, Mine wastes, Pyrite, Iron, Sulfates, Hydrogen ion concentration, Bacteria, Acid bacteria, Sulfur bacteria, Water chemistry, Chemical analysis, Seasonal.

A disused pyrite mine in the Conwy Valley, North Wales, was found to contain copious amounts of 'acid streamer' of heterotrophic bacterial origin. The geology of the mine is discussed and analytical data on the acid stream which flows through the mine are presented. The UV and visible spectra of the typically orange/red-coloured water were investigated and the main ionic species responsible for the colour identified as being Fe(OH)2(+), Fe(SO4)2(-), Fe(SO4)(+). The local pollution caused by the acid discharge is mentioned. (Deal-EIS)
W79-07651

ADAPTATIONS TO SULFIDE IN THE MEIOFAUNA OF THE SULFIDE SYSTEM. I. 35S-SULFIDE ACCUMULATION AND THE PRESENCE OF A SULFIDE DETOXIFICATION SYSTEM,
North Carolina, Univ. at Chapel Hill. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W79-07652

MERCURY ACCUMULATION IN IPOMOEA AQUATICA (FORSK) NEAR A CAUSTIC SODA FACTORY IN THAILAND,
Helsinki Univ. (Finland). Dept. of Environmental Science.
S. Suckcharoen.
Water, Air and Soil Pollution, Vol. 10, p 451-455, 1979. 2 fig, 19 ref.

Descriptors: *Mercury, *Industrial wastes, *Food chains, *Bioaccumulation, *Tissue analysis, *Thailand, *Ipomoea, Path of pollutants, Heavy metals, Chemical wastes, Plant physiology, Public health, Human pathology, Chemical analysis, Water quality standards.

Ipomoea aquatica is commonly used as a vegetable and pig food in Thailand. The present study shows that the leaves and floating stems of this plant collected near a caustic soda factory in Thailand had accumulated between 0.75 to 1.26 ppm (average 0.95 ppm) Hg in the leaves and 0.28 to 0.68 ppm (average 0.43 ppm) Hg in the floatingstems. Leaves and floating stems from unpolluted areas had Hg contents between 0.1 to 0.17 ppm and 0.01 to 0.06 ppm, respectively. The contaminated I. aquatica in the study are represents an additional source of Hg, since fish from the same area are also polluted with Hg. This constitutes a serious risk to public health. (Deal-EIS)
W79-07653

TOXICITY OF PERMETHRIN, DECAMETHRIN, AND RELATED PYRETHROIDS TO SALMON AND LOBSTER,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko, D. W. McLeese, C. D. Metcalfe, and W. G. Carson.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 338-343, 1979. 3 tab, 8 ref.

Descriptors: *Insecticides, *Pesticide toxicity, *Lobsters, *Atlantic salmon, *Pyrethroids, *Permethrin, *Decamethrin, Toxicity, Mortality, Chemical properties, Bioassay, Juvenile growth state, Chemical analysis, Lethal limit, Gas chromatography.

The lethalities of permethrin, its 1R-cis-isomer, decamethrin, and its dichloro angalogue to juvenile Atlantic salmon (Salmo salar) and adult lobster (Homarus americanus) were determined. As expected from the insecticidal activity patterns, 1R-cis permethrin is more lethal than permethrin to both salmon and lobsters. The lethalities of the cyano-substituted pyrethroids are higher than one would expect from the lethality-octanol/water partition coefficient relationship, derived previously. (Deal-EIS)
W79-07654

ALKANES IN PLANKTON FROM THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, E. S. Chang, and B. Basile.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 421-427, 1979. 3 tab, 13 ref.

Descriptors: *Oil, *Oil pollution, *Zooplankton, *Biogenic hydrocarbons, *Alkanes, *Tissue analysis, Offshore platforms, Brines, Metabolism, Organic compounds, Oil spills, Gas chromatography, Chemical analysis, Path of pollutants.

Samples of zooplankton were examined to determine whether they contain petroleum alkanes and whether they might contribute significantly to the dispersion of oil discharged from the production platforms. The total alkane concentrations ranged from 250 ppb to 3.58 ppm. There was also a wide variation in the distribution of alkanes from sample to sample, reflecting species differences. In general, the samples from the center of the oilfield were contaminated with petroleum alkanes while those samples collected at distances from the oilfield predominantly contained biogenic alkanes. (Deal-EIS)
W79-07655

MERCURY POLLUTION OF MEDITERRANEAN SEDIMENTS AROUND ALEXANDRIA, EGYPT,
Alexandria Univ. (Egypt). Faculty of Science.
M. K. El-Sayed, Y. Halim, H. M. Abdel-Kader, and M. H. Moeness.
Marine Pollution Bulletin, Vol. 10, p 84-86, 1979. 1 fig, 3 tab, 11 ref.

Descriptors: *Mercury, *Industrial wastes, *Bottom sediments, *Egypt, Chemical wastes, Path of pollutants, Heavy metals, Sediments, Beaches, Sands, Sewage effluent, Water pollution sources, Chemical analysis, Spectrophotometry, Chlor-alkali plants.

Elemental mercury is associated with industrial wastes discharged through the main effluent pipe of the Chlorine-Alkali plant at El-Max area west of Alexandria. The minimal mercury value of 0.1 ppm dry weight is assumed to be the background level for uncontaminated sediments in the area. Mercury levels ranged from 8.02 to 15.5 ppm in the beach sands from the polluted area beyond the plant, and from 0.14 to 1.4 ppm in the bottom sediments off Alexandria. The Chlorine-Alkali plant is obviously the major source of mercury pollution. The contribution of land drainage, agricultural and domestic wastes is insignificant. (Deal-EIS)
W79-07656

ZINC AND COPPER LEVELS IN BELFAST LOUGH,
Northern Ireland Polytechnic Jordanstown. School of Life Sciences.
M. S. McGrath, and J. Austin.
Marine Pollution Bulletin, Vol. 10, p 86-88, 1979. 1 fig, 2 tab, 6 ref.

Descriptors: *Zinc, *Copper, *Biochemical oxygen demand, *Dissolved oxygen, *Irish Sea, *Belfast Lough(Ireland), Heavy metals, Municipal wastes, Industrial wastes, Water quality, Water chemistry, Chemical analysis, Spectrophotometry, Waste disposal.

A survey of dissolved zinc, copper, oxygen and biochemical oxygen demand in Belfast Lough has been carried out. Zinc and to a lesser extent copper occur at elevated levels compared with a non-industrialized area of the Irish Sea. Zinc levels are particularly high in the marginal waters of the north shore of the lough. Dissolved oxygen and biochemical oxygen demand levels indicate that pollution of the lough by oxygen-demanding wastes is not a serious problem. (Deal-EIS)
W79-07657

APPLICATION OF A NEW BIOASSAY TO SCREEN THE TOXICITY OF POLYCHLORINATED BIPHENYLS ON BLUE-GREEN ALGAE,
Institute fuer Wasserforschung G.m.b.H., Dortmund, (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W79-07658

STUDIES ON THE TOXICITY OF PULP AND PAPER FACTORY WASTES TO THE FISH NOTOPTERUS NOTOPTERUS (PALLAS),
D.A.V. Coll., Muzaffarnagar (India). Pollution-Relevant Research Lab.
S. R. Verma, G. R. Shukla, and R. C. Dalela.
Acta Hydrochimica et Hydrobiologica, Vol. 6, p 541-552, 1978. 8 tab, 23 ref.

Descriptors: *Bioassay, *Pulp wastes, *Toxicity, *Notopterus, Pulp and paper industry, Industrial wastes, Chemical wastes, Water temperature, Hydrogen ion concentration, Dissolved oxygen, Fish physiology, Chemical analysis, Water chemistry, Mortality, Fish behavior.

Studies are performed on the toxicity for 24, 48, 72 and 96 hours in the static test with dilutions of wastewaters from pulp and paper production as well as of the mixed wastewater. The pulp waste shows the highest toxic effect. A general increase of the toxic effect is caused by a rise in temperature from 26 degrees C to 36 degrees C and an increase of the pH value from 7.5 to 8.2. The increase of the oxygen concentration from 5.2 to 7.2 mg/l results in a reduction of the toxicity of the pulp and mixed wastes, the size of fishes having a significant effect only for the pulp waste. (Deal-EIS)
W79-07659

DOMINANCE AND DISTRIBUTION OF BENTHIC MACROPHYTE ASSEMBLAGES IN A NORTH FLORIDA ESTUARY (APALACHEE BAY, FLORIDA),
Florida State Univ., Tallahassee. Dept. of Biological Science.
M. S. Zimmerman, and R. J. Livingston.
Bulletin of Marine Science, Vol. 29, No. 1, p 27-40, 1979. 3 fig, 4 tab, 13 ref.

Descriptors: *Pulp wastes, *Biological communities, *Toxicity, Algae, *Diversity, *Species diversity, Florida, Pulp and paper industry, Industrial wastes, Chemical wastes, Aquatic populations, Rhodophyta, Benthic flora, Water pollution effects, Biomass, Dominant organisms, Apalachee Bay.

A comparative analysis was made concerning the distribution of benthic macrophyte assemblages in shallow portions of Apalachee Bay (north Florida). This included a comparison of areas affected by bleached kraft mill effluents (BKME) (the Fenholloway River system) with appropriate uncontaminated control stations (the Econfina River system). Meter-square samples of benthic macrophytes were collected monthly in both areas. Relative dominance was generally higher in the unpolluted areas. Areas of acute effect were found to have extremely low biomass and characteristic assemblages of various macrophyte species. Most of the species in unpolluted areas were present in portions of the bay characterized by chronic (low) levels of BKME. However, biomass was consistently reduced in such areas when compared to control stations. It was postulated that selective removal of dominant species by BKME (e.g., increased levels of color and turbidity) allowed recruitment of various 'rare' species in areas of chronic impact, thus contributing to anomalous patterns of community structure when compared to published data from other pollution-stressed aquatic systems. (Deal-EIS)
W79-07660

PHYTOPLANKTON COMMUNITY OF AN ACIDIFIED, HEAVY METAL-CONTAMINATED LAKE NEAR SUDBURY, ONTARIO: 1973-1977,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
N. D. Yan.
Water, Air and Soil Pollution, Vol. 11, No. 1, p 43-55, 1979. 4 fig, 3 tab, 32 ref.

Descriptors: *Phytoplankton, *Heavy metals, *Lakes, *Peridinium, Acidic water, Biomass, Biological communities, Phosphorus, Hydrogen ion concentration, Water chemistry, Canada, Seasonal, Spectrophotometry, Chlorophyta, Chrysophyta, Cyanophyta, Sudbury, Ontario.

Phytoplankton data for 1973 to 1977 from Clearwater Lake, an acid- and heavy metal-contaminated lake near Sudbury, Ontario are presented. Peridinium inconspicuum comprised between 30 and 55% of the average, ice-free period biomass of 0.33 to 0.73 mg/l and is considered indicative of acidic lakes if it forms a substantial portion of the total biomass. The data were compared with those from three other contaminated and ten uncontaminated lakes in Ontario. The phytoplankton communities of all contaminated lakes were dominated by P. inconspicuum while chrysophytes dominated the uncontaminated lakes. Community biomass was better correlated with phosphorus concentration than with hydrogen ion concentration. There was some evidence of reductions of biomass in lakes with the highest heavy metal concentrations. Limitations of phytoplankton data collected in synoptic surveys are discussed. (Deal-EIS)
W79-07661

COMPARISON OF THE EFFECTS OF FOURTEEN-DAY AND CHRONIC EXPOSURES TO A POLYCHLORINATED BIPHENYL, AROCLOR 1242, ON MOLTING OF THE FIDDLER CRAB, UCA PUGILATOR,
Tulane Univ., New Orleans, LA. Dept. of Biology.
S. W. Fingerman, and M. Fingerman.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 352-357, 1979. 2 fig, 14 ref.

Descriptors: *Polychlorinated biphenyls, *Crabs, *Toxicity, *Aroclors, *Molting, *Ecdysis, *Uca, Bioassay, Laboratory tests, Growth stages, Growth rates, Animal metabolism, Pesticide toxicity, Chlorinated hydrocarbon pesticides, Inhibition, Water pollution effects.

The object of the present experiments was to determine whether the inhibitory effect of Aroclor 1242 on molting of the fiddler crab can be at least partially reversed by returning the crabs to sea water that did not contain this pollutant after they had been exposed to it for 14 days. It was discovered that crabs removed from the effect of Aroclor-1242 underwent ecdysis at a faster rate (7%) than those kept continuously in PCB-contaminated water, but still at a much slower rate than the control group. It appears that once the crabs had been exposed for 14 days they accumulated enough PCB to have a long-lasting inhibitory effect on molting. (Deal-EIS)
W79-07662

THE INFLUENCE OF REARING DENSITY ON THE SUBSEQUENT RESPONSE TO DDT DOSING FOR TADPOLES OF THE FROG RANA TEMPORARIA,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
A. S. Cooke.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 837-841, 1979. 2 tab, 10 ref.

Descriptors: *DDT, *Frogs, *Pesticide toxicity, *Tadpoles, *Tissue analysis, *Bioaccumulation, *Rana, Growth stages, Growth rates, Animal populations, Density, Chlorinated hydrocarbon pesticides, Pesticide kinetics, Path of pollutants, Pesticide residues, Animal behavior, Animal physiology.

By rearing at two densities that differed five-fold, tadpoles were produced that differed in weight, by a factor of about two-fold. When treated with DDT(0.1ppm), the large tadpoles showed no poisoning symptoms under conditions that caused appreciable sublethal effects amongst the small tadpoles. Relative to tadpoles in the field or in stock captive cultures, neither the small nor the large tadpoles were particularly unusual as regards size, although both tended towards the extremes of the normal size range. In addition, the small tadpoles accumulated higher body burdens of DDT. (Deal-EIS)
W79-07663

OXYGEN CONSUMPTION IN LEPOMIS MACHROCHIRUS EXPOSED TO 2,4-D OR 2,4,5-T,
Clemson Univ., SC. Dept. of Zoology.
C. Sigmon.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 826-830, 1979. 2 tab, 11 ref.

Descriptors: *2,4-D, *2,4,5-T, *Pesticide toxicity, *Sunfishes, *Tissue analysis, Water pollution effects, Lepomis, Bluegill sunfish, Respiration, Oxygen requirements, Herbicides, Chlorinated hydrocarbon pesticides, Water temperature, Chemical analysis, Fish physiology, Absorption.

Respiratory changes and herbicide uptake by Lepomis machrochirus were analyzed following short-term exposure to 3 ppm of 2,4-D or 2,4,5-T at three water temperatures (20, 25, 30 degrees C). While weight and temperature were found to be significant variables in determining respiration, exposure to the herbicides was not. Herbicide uptake was quite small. More 2,4,5-T than 2,4-D was retained by the fish. Since 2,4-D is more rapidly degraded by microorganisms, less would be available for uptake. (Deal-EIS)
W79-07664

THE EFFECTS OF AN EXPERIMENTAL SPILLAGE OF OIL SANDS TAILINGS SLUDGE ON BENTHIC INVERTEBRATES,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
D. R. Barton, and R. R. Wallace.
Environmental Pollution, Vol. 18, p 305-312, 1979. 4 tab, 15 ref.

Descriptors: *Oil spills, *Toxicity, *Benthic fauna, *Crude oil, Oil pollution, Oil, Organic compounds, Canada, Bioindicators, Sediments, Bottom sediments, On-site investigations, Heavy metals, Sands, Alberta, Benthos, Aquatic insects.

A very minor, instantaneous spillage of oil sands tailings sludge was introduced experimentally to a small part of a river in northern Alberta, Canada. A 60% reduction in the standing stock of benthic invertebrates occurred throughout a four-week period in the immediate area of the spillage. Sensitive indicator organisms decreased in abundance over an area of at least 30 m downstream of the spillage. The tailings sludge contained fine silt, heavy, sticky oils and heavy metals, all of which would have a deleterious effect on stream benthos. The fine silt mixed with the sticky oils of the sludge probably constituted the principal hazard to aquatic communities. It is recommended that appropriate measures should be established so as to prevent the addition of oil sands tailings sludge, by either accident or design, to lakes or rivers. (Deal-EIS)
W79-07665

OXYGEN CONSUMPTION IN DAPHNIA PULEX EXPOSED TO 2,4-D OR 2,4,5-T,
Clemson Univ., SC. Dept. of Zoology.
C. Sigmon.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 822-825, 1979. 2 tab, 6 ref.

Descriptors: *Pesticide toxicity, *Daphnia, *Oxygen requirements, *2,4-D, *2,4,5-T, Oxygen, Chlorinated hydrocarbon pesticides, Herbicides, Toxicity, Water temperature, Chemical analysis, Respiration, Animal physiology, Water pollution effects.

Oxygen consumption by Daphnia pulex was measured for 9 hours following exposure to two concentrations (1,3ppm) of 2,4-D or 2,4,5-T at three water temperatures (20, 25, 30 degrees C). A general trend of increased respiration at 30 degrees C was apparent in both the 2,4-D and 2,4,5-T experiments, although the differences achieved statistical significance only in the 2,4,5-T data. The physiological basis for the effect of these herbicides on respiration is not known. (Deal-EIS)
W79-07666

ORGANOCHLORINE INSECTICIDE RESIDUES IN AMPHIBIANS AND REPTILES FROM IOWA AND LIZARDS FROM THE SOUTHWESTERN UNITED STATES,
Iowa State Univ., Ames. Dept. of Entomology.
F. Punzo, J. Laveglia, D. Lohr, and P. A. Dahm.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 842-848, 1979. 2 tab, 8 ref.

Descriptors: *Pesticide residues, *Reptiles, *Amphibians, *Tissue analysis, *Lizards, Chlorinated hydrocarbon pesticides, Chemical analysis, Pesticide kinetics, Iowa, Southwest U.S., DDT, Dieldrin, DDE, Toads, Heptachlor, Frogs, Food chains, Snakes.

Ecosystems are generally contaminated with low levels of organochlorine insecticide residues. Numerous reports of residues in biota include relatively little data for amphibians and reptiles. To help fill this void, specimens of amphibians and reptiles were collected from 2 agricultural areas of Iowa, and lizards were collected from nonagricultural areas in Arizona, New Mexico, and Texas. Iowa specimens came from a region with past use of organochlorine insecticides, particularly DDT as a general purpose insecticide and aldrin and heptachlor for control of soil-insect pests. Only residues of DDE and dieldrin in viscera of toads and of DDE, dieldrin, heptachlor epoxide in fat and eggs from reptiles were found in specimens collected in Iowa. Low or nondetectable residues of DDE and dieldrin were found in carcass and viscera samples from lizards collected in the southwestern United States. (Deal-EIS)
W79-07667

EMBRYOTOXICITY AND HATCHABILITY IN CICHLASOMA NIGROFASCIATUM (GUENTHER) EGGS AND LARVAE BRIEFLY EXPOSED TO LOW CONCENTRATIONS OF ZINC AND COPPER IONS,
Uppsala Univ. (Sweden). Inst. of Zoology.
P. T. E. Ozoh, and C.-O. Jacobson.

Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 782-786, 1979. 2 tab, 11 ref.

Descriptors: *Zinc, *Copper, *Toxicity, *Cichlids, *Zebrafish, *Mutagens, Fresh water fish, Fish eggs, Larval growth stage, Embryonic growth stage, Hatching, *Metals, Fish physiology, Ions, Mortality, Bioassay.

Zebra cichlid eggs were exposed to 0, 16 and 32 ppb of zinc and copper singly and in combination. The presence of copper ions affected both eggs and larvae. The pro-larvae and larvae exposed to copper ions for 48 h showed many morphological malformations, especially in the nervous system. Zinc ions caused no observable malformations in eggs or larvae. In terms of hatchability, zinc had a more severe effect. This was to copper's bacteriocidal effect at low concentrations, which facilitated hatching. For the two factor interactions of zinc and copper, concentrations of 32 ppb zinc and 16 ppb produced the lowest hatching success. (Deal-EIS)
W79-07668

INDUCTION OF BENZO (A) PYRENE MONOOXYGENASE IN FISH AND THE SALMONELLA TEST AS A TOOL FOR DETECTING MUTAGENIC/CARCINOGENIC XENOBIOTICS IN THE AQUATIC ENVIRONMENT,

Institut Rudjer Boskovic, Zagreb (Yugoslavia). Lab. for Marine Molecular Biology.
B. Kurelec, Z. Motajaseric, M. Rijarec, M. Alaceric, and S. Britvic.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 799-807, 1979. 1 fig, 1 tab, 23 ref.

Descriptors: *Toxicity, *Carp, *Enzymes, *Salmonella, *Mullets, *Mutagens, *Carcinogens, *Tissue analysis, *Crude oil, *Hexane, *Aflatoxin, Chemical analysis, Organic compounds, Fish physiology, Sea water, Path of pollutants.

Considering the induction of Benzopyrene Monoxygenase as a means of detoxification in fish, we studied the consequences of i/p application of polluted water extracts from different marine sites to young carp. Aliquots of these extracts served in Salmonella/microsome mutagenicity tests using liver homogenates of pollution-induced fish as activating systems. The pollutants tested were hexane, commercial corn oil, aflatoxin, NADP, NADPH, glucose-6-phosphate, dimethyl sulphoxide, and benzo(a)pyrene. A single i/p injection of 25 or 50 ug benzo(a)pyrene, 25 ug aflatoxin, 50 ul crude oil and hexane extract of seawater was sufficient to induce BPMO activity in carp within one or two days. The ability of the compounds to induce mutations in Salmonella typhimurium was influenced by the presence of liver postmitochondrial fraction. (Deal-EIS)
W79-07669

SCHEMA OF LETHAL ACTION OF COPPER ON MUSSELS,

Centre Oceanologique de Bretagne, Brest (France).
J. L. M. Martin.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 808-814, 1979. 3 fig, 1 tab, 14 ref.

Descriptors: *Copper, *Toxicity, *Mussels, *Bioaccumulation, *Tissue analysis, *Mytilus, Bioassay, Chemical analysis, Path of pollutants, Chemical reactions, Lethal limit, Bioassay, Animal physiology, Animal metabolism, Metals, Spectrophotometry, Chemical properties, Mode of action.

In order to demonstrate the relationships between concentration, lethal time and bioaccumulation levels and rates in determining the response of an organism to a toxic element, experiments were carried out on Mytilus edulis using copper as the test element. The results show that the toxicity of copper to mussels is regulated by a two step reaction. The first factor is the speed of accumulation in the test organism while the second determining factor is the speed of action of the test element in producing toxic effects at the target organ(s). (Deal-EIS)
W79-07670

ACUTE TOXICITY OF DECHLORINATED DDT, CHLORDANE AND LINDANE TO BLUEGILL (LEPOMIS MACROCHIRUS) AND DAPHNIA MAGNA,

Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
W. F. Randall, W. H. Dennis, and M. C. Warner.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 849-854, 1979. 2 tab, 9 ref.

Descriptors: *DDT, *Pesticide toxicity, *Daphnia, *Sunfishes, *Catalysts, *Chlordane, *Lindane, *Dechlorination, Zooplankton, Fresh water fish, Chlorinated hydrocarbon pesticides, Chemical analysis, Chemical reactions, Catalysts, Nickel, Chemical wastes, Waste disposal, Insecticides, Bioassay, Waste treatment.

The purpose was to test the effectiveness of Ni2B-catalyzed dechlorination in reducing the acute toxicity of DDT, chlordane and lindane to bluegill and daphnia. It was discovered that the acute toxicity of DDT and chlordane formulations was considerably reduced by nickel boride-catalyzed dechlorination. However, the reduction in toxicity was not sufficient to warrant the use of this method for the ultimate disposal of these pesticides. The dechlorination of lindane by this method appears to have potential as a chemical disposal procedure. (Deal-EIS)
W79-07671

THE REPRODUCTION BEHAVIOR OF GAMMARUS DUEBENI (LILLJEBORG), AND THE INHIBITORY EFFECT OF A SURFACE ACTIVE AGENT,

Southampton Univ. (England). Dept. of Oceanography.
M. C. Lyes.
Marine Behavior and Physiology, Vol. 6, p 47-55, 1979. 5 fig, 16 ref.

Descriptors: *Animal behavior, *Reproduction, *Surfactants, *Toxicity, *Gammarus, *Chemoreceptors, *TWEEN 80, *Pheromones, Bioassay, Inhibition, Bioassay, Crustaceans, Chemical analysis, Animal physiology, Amphipoda.

The process by which reproductive behavior in the male Gammarus duebeni is evoked has been found to depend upon the reception of a chemical cue from the female. This cue is perceived by receptors on the second antennae and its function is to synchronize mating with the suitable phase of ecdysis in the female. Small concentrations of the surfactant TWEEN80 are shown to interfere with the reception of this chemical cue, resulting in a decrease in mating success. (Deal-EIS)
W79-07672

CHEMOSENSORY INDUCED BRADYCARDIA IN THE KELP CRAB, PUGETTIA PRODUCTA (RANDALL),

California Univ., Santa Barbara. Dept. of Biological Sciences.
R. K. Zimmer, D. P. Cook, and J. F. Case.
Journal of Experimental Marine Biology and Ecology, Vol. 38, p 135-150, 1979. 5 fig, 5 tab, 31 ref.

Descriptors: *Animal physiology, *Crabs, *Inhibition, *Carbohydrates, *Chemoreceptors, *Water soluble fraction, Animal metabolism, Chemical analysis, Amino acids, Oil, Toxicity, Organic compounds, Crustaceans, Chemical properties.

Bradycardia was induced in specimens of Pugettia producta by chemical stimulation of the branchial chamber with synthetic clam extract. Chemical stimulation of the dactyls, antennules, and mouthparts did not effect cardiac inhibition. Stimulation of the branchial chamber with amino acids and sugars evoked cardiac inhibition that was significantly greater than that induced by sea-water controls. Of the sugars tested, disaccharides were generally found to have a greater capacity to induce bradycardia than monosaccharides. The possibility of a disaccharide or polysaccharide receptor is discussed. Taurine and B-alanine induced bradycardia was significantly greater than that effected by other amino acids. All tested amino acids were, however, at least mildly effective ($P < 0.10$); thus it appears that several types of amino-acid receptors are likely to exist. From these results and from observations described by other investigators, it is apparent that the branchial chamber is a major chemoreceptive site in decapod crustaceans. (Deal-EIS)
W79-07673

IN VIVO EFFECT ON ATPASE IN CERTAIN TISSUES OF LABEO ROHITA AND SACCOBRANCHUS FOSSILIS, FOLLOWING CHRONIC CHLORDANE INTOXICATION,

D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, S. K. Bansal, A. K. Gupta, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 20, p 769-777, 1978. 2 tab, 18 ref.

Descriptors: *Pesticide toxicity, *Enzymes, *Tissue analysis, *Chlordane, *Labeo, *Saccobranchus, Chlorinated hydrocarbon pesticides, Biochemistry, Fish physiology, Chemical analysis, Sodium, Potassium, Magnesium, Freshwater fish.

The purpose of this study was to determine the effect of various concentrations of chlordane upon the ATPase system in the brain, gill, liver and kidney or two fresh water teleosts, Labeo rohita and Saccobranchus fossilis, following chronic chlordane intoxication after 30 and 60 days treatment. Mg++, Na+ and K+ ATPases were analyzed. The present investigation observed inhibition of all the three ATPases in both fish Labeo rohita and Saccobranchus fossilis in all tissues, following chronic chlordane treatment. However, inhibition of ATPases in all the tissues of Labeo rohita was found higher as compared to Saccobranchus fossilis, indicating more susceptibility of the former to chlordane. (Deal-EIS)
W79-07674

DISTRIBUTION OF CHAETOGNATHS ALONG THE SALINITY GRADIENT IN THE COCHIN BACKWATER, AN ESTUARY CONNECTED TO THE ARABIAN SEA,

National Inst. of Oceanography, Cochin (India); and Indian Ocean Biological Centre.
V. R. Nair.
Journal of the Marine Biological Association of India, Vol. 16, No. 3, p 721-730, 1974. 5 fig, 1 tab, 15 ref.

Descriptors: *Fish populations, *Salinity, *Chaetognaths, Temporal distribution, Diel migration, Spatial distribution, Seasonal, Monsoons, Estuaries, Growth stages, Fish behavior, Fish migration, Diurnal distribution, Arabian Sea, India.

A study was made of the chaetognaths of the Cochin Backwater. Krohnitta pacifica Aida, Sagitta bedoti Beraneck, Sagitta enflata Grassi and S. oceania Gray were the species found in the collections. S. bedoti was the dominant chaetognath. S. oceania is recorded for the first time from Indian waters. Salinity plays a major part in controlling the distribution of chaetognaths in this estuary. They penetrated to the southernmost part of the estuary during the premonsoon period when a uniform high salinity prevailed throughout the system. In the postmonsoon period the chaetognath population synchromically followed the steep gradient in salinity along the estuary and became restricted to its seaward end. It is suggested that during the monsoon period they are removed from the area and fresh recruits from the sea are brought back to the system along with the incoming waters of the postmonsoon periods. (Deal-EIS)
W79-07675

DETECTION OF NAPHTHALENE BY THE BLUE CRAB, CALLINECTES SAPIDUS,

National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
For primary bibliographic entry see Field 5A.
W79-07676

INTERTIDAL ECOLOGY OF THE SEA SHORE NEAR TARAPUR ATOMIC POWER STATION,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
M. C. Balani.
Journal of the Marine Biological Association of India, Vol. 17, No. 1, p 101-106, 1975. 2 fig, 6 ref.

Descriptors: *Nuclear powerplants, *Littoral, Tides, Beaches, Radioisotopes, Intertidal areas, Shores, Seasonal, Oysters, Clams, Manganese, Zinc, Potassium, Iodine, Iron, Strontium, Food chains, Crabs, Tarapur Atomic Power Station.

Surveys were carried out between March 1969 and August 1970 to study the fauna and flora in the littoral zone of the sea shore near the Tarapur Atomic Power Station. The beach adjacent to the station is rocky with a number of tidal pools inhabited by a variety of organisms whereas the beach to the south is mostly sandy and barren except for a small rocky stretch. The tidal range is 6 m and over a mile of beach is exposed during low tide. The near shore currents are very strong and have a clear north-south oscillation with the changing tides. Less Atherina sp. fry were available near the Power Station in March 1970 than during the previous year. Possible reasons for these differences are discussed, including the effect of heated discharges on biota. The need is also emphasized to monitor the biota (Plankton, Nekton and Benthos) systematically for content of fission products released by the Power Station. (Deal-EIS)
W79-07677

KEPONE: TOXICITY AND BIOACCUMULATION IN BLUE CRABS,
Environmental Research Lab., Gulf Breeze, FL.
S. C. Schimmel, J. M. Patrick, Jr., L. F. Faas, J. L. Oglesby, and A. J. Wilson, Jr.
Estuaries, Vol. 2, No. 1, p 9-15, 1979. 4 fig, 3 tab, 11 ref.

Descriptors: *Toxicity, *Crabs, *Insecticides, *Kepone, *Bioaccumulation, *Depuration, *Callincetes, *Tissue analysis, *James River(Virginia), Blue crabs, Absorption, Animal physiology, Path of pollutants, Oysters, Pesticide residues, Pesticide kinetics, Mortality, Pesticide toxicity.

Two long-term studies were conducted to determine toxicity, uptake and depuration of Kepone in blue crabs (Callinectes sapidus). In the first, Kepone was administered to crabs in seawater or food. Uptake of Kepone in 28 days was primarily through the contaminated oysters. When these crabs were held in Kepone-free seawater and fed Kepone-free oysters for 28 days, no loss of the insecticide was evident. There were adverse effects on molting and survival in crabs fed oysters that contained 0.25 micrograms/g Kepone. A second study was conducted to determine: (1) the depuration of Kepone over a 90-day period in blue crabs fed oysters from the James River, Virginia (containing 0.15 micrograms/g Kepone); and (2) the effects of Kepone on molting and survival of blue crabs fed James River oysters or laboratory-contaminated oysters that contained 0.15 or 1.9 micrograms/g Kepone. Crabs fed Kepone-contaminated oysters followed by a diet of Kepone-free oysters for 90 days had detectable concentrations of the insecticide in tissues. Also, blue crabs that ate oysters containing Kepone in concentrations similar to those found in oysters from the James River, died or molted less frequently than crabs fed Kepone-free oyster meats. (Deal-EIS)
W79-07679

A MATHEMATICAL MODEL FOR THE UPTAKE OF HEAVY METALS IN BENTHIC ALGAE,
Central Inst. for Industrial Research, Oslo (Norway).
K. L. Seip.
Ecological Modelling, Vol. 6, p 183-197, 1979. 12 fig, 4 tab, 11 ref.

Descriptors: *Heavy metals, *Marine algae, *Methodology, *Mathematical models, *Zinc, Algae, Mathematical studies, Benthic flora, Water pollution effects, Path of pollution, Toxicity, Chemical analysis, Biomass, Mortality, Sea water, Simulation studies, Ascophyllum nodosum.

A mathematical model for the uptake of heavy metals in the benthic algae Ascophyllum nodosum has been developed. The model allows assignment of age-dependent growth parameters which also may be a function of external factors. Mortality curves for A. nodosum corresponding to a highly polluted and a nearly unpolluted area have been used in the study of metal uptake. Uptake has been simulated for different values of growth parameters and different concentrations of heavy metals in seawater. Emphasis has been on the uptake of zinc. The simulations showed that the concentration of zinc in the algae changed much less (6%) than the biomass (30%) with changes in intrinsic growth rate, mortality and carrying capacity. The concentration in the algae was found to be an approximately linear function of the mean concentration in seawater up to about 100 ppb. At very high concentrations, associated with high mortality, the deviation from linearity may be significant (about 13% at 162 ppb at one locality). The calculation indicates further that variations in the zinc concentration in the seawater are considerably damped in the algae. Simulations have also been performed to study the effects of sampling different parts of the algae, and some initial simulations have been performed to study the effects of heavy metal exchange between algae and sea water. (Katz-EIS)
W79-07680

GROWTH DYNAMICS OF CORDGRASS, SPARTINA ALTERNIFLORA, LOISEL., ON CONTROL AND SEWAGE SLUDGE FERTILIZED PLOTS IN A GEORGIA SALT MARSH,
Georgia Univ., Sapelo Island. Marine Inst.
E. B. Haines.
Estuaries, Vol. 2, No. 1, p 50-53, 1979. 4 fig, 1 tab, 13 ref.

Descriptors: *Sewage sludge, *Plant growth, *Growth rates, *Cordgrass, *Spartina, Fertilizers, Sewage sludge disposal, Biomass, Nitrogen, Nitrogen compounds, Seasonal, Salt marshes, Soils, Estuaries.

Seasonal plant growth dynamics were followed for a year in undisturbed plots of tall and short form Spartina alterniflora and in plots of short form S. alterniflora which were enriched with sewage sludge. Monthly determinations of aboveground live and dead biomass, density of live stems, the ratio of number of young shoots to total number of shoots, and belowground mass of macro-organic matter to a depth of 30 cm were made for each area. Sludge fertilization increased the live biomass of the short form S. alterniflora by up to 150% of the control live biomass, but had little effect on the dead biomass, stem density, or proportion of young shoots. There was a trend of increased amount of belowground macroorganic matter in fertilized compared to control plots during the last 6 months of the study. In all areas, there was a marked decrease in the proportion of young shoots from winter to early summer, followed by a rapid increase in the percent of young shoots from late summer to fall. Sampling of plots 7 and 20 months after termination of sludge enrichment showed higher plant biomass and % N content in surface soils, but no difference in N content of live plant tissue, in fertilized compared to unfertilized marsh. After 20 months, about half of the sludge nitrogen remaining in the soils of the fertilized plots had disappeared. (Deal-EIS)
W79-07681

DISTRIBUTION OF MIREX IN AN EXPERIMENTAL ESTUARINE ECOSYSTEM,
Environmental Research Lab., Gulf Breeze, FL.
W. P. Schoor.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 315-321, 1979. 1 fig, 2 tab, 12 ref.

Descriptors: Pesticide kinetics, *Shrimp, Laboratory tests, Water pollution effects, *Tissue analysis, *Bioaccumulation, *Mirex, *Palaemonetes, *Thalassia, Pesticide residues, Grasses, Path of pollutants, Estuarine environment, Ecosystems, Gas chromatography, Chemical analysis, Animal metabolism.

The purpose of these experiments was to determine the movement and accumulation of mirex in an experimental ecosystem by utilizing a method of introducing mirex that is representative of what occurs in the natural environment. Experimental aquaria contained sand, grass plants (Thalassia) and grass shrimp (Palaemonetes) in artificial seawater. Test aquaria were exposed to varying concentrations of mirex, then sampled over a period of two weeks. Results showed that the shrimp hepatopancreas was the only living component in which the concentration of mirex increased throughout the test period. Small but constant levels were detected in other shrimp tissues and grass, probably due to adsorption. (Deal-EIS)
W79-07682

THE EFFECTS OF TEMPERATURE AND DIFFERENT FOOD ORGANISMS ON THE RATE OF GASTRIC EVACUATION IN PERCH (PERCA FLUVIATILIS),
Lund Univ. (Sweden). Limnology Inst.
L. Persson.
Freshwater Biology, Vol. 9, p 99-104, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Digestion, *Fish physiology, *Perches, *Water temperature, *Tissue analysis, *Gammarus, Thermal pollution, Fish food organisms, Zooplankton, Diptera, Annelids, Fish diets, Mathematical models, Animal metabolism.

The rate of gastric evacuation in perch was studied at different mean temperatures (range 4.0-21.7 degrees C). Gastrix evacuation rates were empirically described by an exponential function and the relationship between the instantaneous evacuation rate and temperature was also exponential. Evacuation rates were not significantly different ($P>0.1$) for the following food organisms: Gammarus pulex, Chaoborus, chironomids and zooplankton. The effects of temperature, different food organisms and fish size on the evacuation rates in different fish species are discussed. (Deal-EIS)
W79-07683

SOME ECOLOGICAL EFFECTS OF THE VENPET - VENOIL COLLISION,
Department of Industries, Sea Point (South Africa). Sea Fisheries Branch.
A. Moldan, P. Chapman, and H. O. Fourie.
Marine Pollution Bulletin, Vol. 10, p 60-63, 1979. 2 fig, 16 ref.

Descriptors: *Oil spills, *Oil pollution, *Intertidal areas, *Crude oil, *Winkles, *Limptes, *Barnacles, Path of pollutants, Oil, Organic compounds, Estuaries, Mortality, Tidal effects, Crabs, Beaches, Rivers, Littoral, Estuarine environment, Venpet-Venoil collision, South Africa.

The effects of oil, released after the Venpet-Venoil collision in December 1977, on the intertidal fauna along the South Coast of South Africa have been monitored at monthly intervals since the incident. Localized areas, such as estuaries and sheltered coves, suffered the greatest damage due to the smothering effects of the oil. Damage to the remaining areas has been slight owing to the patchy distribution of the oil together with its physical and chemical characteristics. (Deal-EIS)
W79-07684

THE DISTRIBUTION OF HEAVY METALS IN THE HARD CLAM, MERCENARIA MERCENARIA, IN THE LOWER CHESAPEAKE BAY REGION,
Bigelow Lab. for Ocean Sciences, Boothbay Harbor, ME.
For primary bibliographic entry see Field 5B.
W79-07685

MODELLING THE DISTRIBUTION AND EFFECT OF HEAVY METALS IN AN AQUATIC ECOSYSTEM,

Royal Danish School of Pharmacy Copenhagen. Dept. of Chemistry.
S. E. Jorgensen.
Ecological Modelling, Vol. 6, p 199-222, 1979. 7 fig, 11 tab, 77 ref.

Descriptors: *Metals, *Heavy metals, *Methodology, *Model studies, *Geosystems, Environmental effects, Path of pollutants, Toxicity, Sediments, Water, Trophic level, Toxicant exchange, Suspended solids, Suspended matter, Adsorption, Reviews, Freshwater fish, Daphnia, Biomass, Lead, Sea water.

Models are reviewed describing the distribution and effect of heavy metals in an aquatic ecosystem. Since a model used for an impact statement should give the maximum concentration level rather than the seasonal variation, a model focussing on this situation is suggested. The basic differential equations describe (1) the variation in concentration of the toxicant per biomass dry matter in a given trophic level, and (2) the exchange of toxicant between sediment and water. Furthermore, since a substantial part of the heavy metal in an aquatic ecosystem is bound to suspended matter, an equation describing the equilibrium between dissolved and suspended matter must be included. A literature review has been carried out on the parameters used in the above mentioned equations and a demonstration, showing how it is possible to find approximate values for such parameters as excretion coefficient and uptake coefficient on the basis of a relationship between these two parameters and the size of an organism, is given. (Katz-EIS)
W79-07686

FACTORS INFLUENCING PH IN LAKE WATER,
Swedish Water and Air Pollution Research Lab., Goteborg (Sweden).
For primary bibliographic entry see Field 5A.
W79-07687

TRANSPORT, DISTRIBUTION AND TOXIC EFFECTS OF POLYCHLORINATED BIPHENYLS IN ECOSYSTEMS: REVIEW,
Tennessee Univ., Knoxville. Memorial Research Center and Hospital.
E. V. Kalmaz, and G. D. Kalmaz.
Ecological Monitoring, Vol. 6, p 223-251, 1979. 5 tab, 80 ref.

Descriptors: *Water pollution effects, *Toxicity, *Chlorinated hydrocarbons, *Environmental effects, Industrial wastes, Path of pollutants, Transport, Transport depletion, Polychlorinated biphenyls, Ecological distribution, Ecosystems, Chemical analysis, Chemical properties, Chemical reactions, Physical properties, Physicochemical properties, Environmental impacts, Ecological magnification, Trophic level.

Investigation of various aspects of the ecological problems of polychlorinated biphenyls (PCBs) has grown and continues to grow with remarkable intensity. However, it appears that certain areas of PCBs research are developed further than the others. For example, chemical and physical behavior and synthesis of PCBs are well studied, while the metabolism of PCBs and other routes of degradation, including toxicological significance and environmental impact, continue to challenge the scientists. In this paper, the chemical and physical properties of PCBs as well as the implications of these properties for the behavior of PCBs in ecological systems are discussed. The effect of PCBs on interrelated ecological systems are described. The distribution and fate of PCBs in the atmosphere, hydrosphere and lithosphere, and transport of PCBs through these systems are discussed. The toxic significance, biological accumulation and ecological magnification are described at various trophic levels. (Katz-EIS)
W79-07688

UPTAKE FROM SEAWATER AND CLEARANCE OF P,P'-DDT BY MARINE PLANKTONIC CRUSTACEA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
G. C. H. Harding, and W. P. Vass.
Journal of the Fisheries Research Board of Canada, Vol. 36, p 247-254, 1979. 2 fig, 4 tab, 41 ref.

Descriptors: *DDT, *Chlorinated hydrocarbon, *Insecticides, *Zooplankton, Crustacean, Seawater, Biological concentration, Excretion, Clearance rates, Euphausiids, Copepods, Path of pollutants, Water pollution effects, Mathematical studies, Food chain.

A simple exponential model is used to interpret the simultaneous uptake and clearance of p,p'-DDT by euphausiids and copepods to and from seawater. The clearance rate constant for euphausiids, is not significantly different from that observed for copepods. No trend value is detected over the range of p,p'-DDT concentrations in seawater used, 27.8-1388 ng/L. Furthermore, there is a great deal of overlap in the uptake rate constant values between organisms. Uptake rate constants range from 0.76 to 1.21 x 10 to the 4th power/d for euphausiids and from 1.04 to 2.51 x 10 to the 4th power/d for copepods. Knowing levels of Sigma DDT present in planktonic crustaceans in nature, back calculations suggest that there must be << 0.1 ng Sigma DDT/L in seawater. A considerable amount of the Sigma DDT reported in seawater must therefore be unavailable to plankters because it is 'bound' to particles. (Katz-EIS)
W79-07690

CADMIUM SORPTION IN ESTUARINE MUD-TYPE SEDIMENT AND THE ACCUMULATION OF CADMIUM IN THE SOFT-SHELL CLAM, MYA ARENARIA,
District of Columbia Univ., Washington. Mount Vernon Square Campus.
H. L. Phelps.
Estuaries, Vol. 2, No. 1, p 40-44, 1979. 3 fig, 3 tab, 22 ref.

Descriptors: *Cadmium, *Cadmium radioisotopes, *Clams, *Bottom sediments, *Mya, *Tissue analysis, *Bioaccumulation, Humic acids, Bentonite, Absorption, Metals, Path of pollutants, Estuaries, Chemical analysis, Bioassay, Proteins, Animal physiology, Chesapeake Bay.

Young Mya arenaria were exposed to cadmium-109 sorbed to humic acid, bentonite, protein (albumin), mud-type sediment and filtered estuarine water in a 24-hour static assay. After 3 1/2 hours, shells had sorbed twice as much cadmium as tissues. Cadmium-109 was linearly accumulated over 24 hours by Mya exposed to cadmium in estuarine water and bentonite-sorbed cadmium. Protein(albumin)-sorbed cadmium was not accumulated by Mya. Final 24-hour average accumulation levels of sorbed cadmium compared to cadmium in estuarine water were: bentonite-cadmium, 100%; humic acid-cadmium, 60%; mud sediment-cadmium, 33%; albumin-cadmium, 12%. (Deal-EIS)
W79-07691

HYPOTHERMAL MORTALITY IN MARINE FISHES OF SOUTH-CENTRAL FLORIDA JANUARY, 1977,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
R. G. Gilmore, L. H. Bullock, and F. H. Berry.
Northeast Gulf Science, Vol. 2, No. 2, p 77-97, 1978. 4 fig, 3 tab, 51 ref.

Descriptors: *Fishkill, *Cold resistance, *Water temperature, *Hypothermia, Tampa Bay, Indian River, Sanibel Island, Thermal stress, Mortality, Fish physiology, Marine fish, Growth stages, Air temperature, Weather, Fronts(Atmospheric), Florida, Tropical fish.

Comparable climatic conditions on both coasts of central Florida resulted in cold induced fish mortalities from 19 January to 13 February 1977. Lethal temperatures, the species killed and their relative numbers killed are compared for the Indian River lagoon, Tampa Bay and Sanibel Island estuarine systems. Fifty-six species were killed in the Indian River area, 36 in the Tampa Bay area, while 19 died at Sanibel Island. The higher species mortality in the Indian River lagoon may be attributed to local hydrological and topographical conditions and a richer ichthyofauna. Cold-induced mortality was noted in both juvenile and adult tropical fishes. Some tropical species appear to be more eurythermic than others as lethal minimum temperatures ranged from 6 to 13 C. Hypothermal stress and mortality were observed in offshore reef fishes. (Deal-EIS)
W79-07692

PLANKTON OF THE HOOGHLY ESTUARY WITH SPECIAL REFERENCE TO SALINITY AND TEMPERATURE,
Central Inland Fisheries Research Inst., Barrackpore (India).
S. B. Saha, B. B. Ghosh, and V. Gopalakrishnan.
Journal of the Marine Biological Association of India, Vol. 17, No. 1, p 107-120, 1975. 6 fig, 6 tab, 6 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Salinity, *Water temperature, Plankton, Diatoms, Seasonal, Rivers, Estuarine environment, Copepods, Commercial fishing, Cyanophyta, Chlorophyta, Monsoons, Rotifers, India, Hooghly Estuary, Hooghly River, Matlah River.

The results of investigations conducted on the plankton fluctuations in the Hooghly-Matlah estuarine system are presented. The upper zones of rivers Hooghly and Matlah have been found to be rich in phytoplankton. Taking the entire estuarine system, generally two peaks of phytoplankton abundance, with yearly variations in their magnitude are observed, the diatoms playing the most important part in determining the pattern of seasonal variations. Among the zooplankters, copepods form the dominant group. Two annual peaks of abundance have also been observed in the case of zooplankton abundance. The surface water temperature of the estuarine system varied between 19.0C and 32.5C, with the annual range of variation between 7.7C and 12.08C. The salinity varied from traces to 32.77% in different zones. Information so far gathered on the plankton in this major estuarine system, in relation to salinity and temperature fluctuations, is reviewed and discussed, with special reference to the fisheries potential of the area. (Deal-EIS)
W79-07693

ESTUARIES,
University Coll. of Swansea (Wales). Dept. of Botany.
For primary bibliographic entry see Field 2L.
W79-07722

PETROLEUM INDUSTRY IN THE DELAWARE ESTUARY,
Academy of Natural Sciences of Philadelphia, PA.
For primary bibliographic entry see Field 2L.
W79-07725

DEVELOPER'S HANDBOOK,
Connecticut Dept. of Environmental Protection, Hartford. Coastal Area Management Program.
For primary bibliographic entry see Field 6B.
W79-07735

SURVIVAL OF EUGLENA GRACILIS EXPOSED TO SUBLETHAL TEMPERATURE AND HEXAVALENT CHROMIUM,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
W. H. Yongue, Jr., B. L. Berrent, and J. Cairns, Jr.
Journal of Protozoology, Vol. 26, No. 1, p 122-125, 1979. 4 fig, 3 tab, 12 ref.

Descriptors: *Chromium, *Toxicity, *Water pollution sources, *Temperature, *Lethal limit, *Euglena, Microorganisms, Laboratory tests, Heat resistance, Thermal stress, Water quality.

The joint effects of exposure to various concentrations of chromium trioxide and to sublethal temperature were examined on Euglena gracilis. The

experiments were performed to determine the highest temperature at which the organisms survive for three hours, the highest concentration of chromium trioxide at which most of these organisms survive for three hours, and the combined effects of the determined temperature and chromium concentration on the organisms. Chromium trioxide with hexavalent chromium appears relatively stable in water, but is more toxic than other chromium oxides due to its odixizing potential and ease of penetration of biological membranes. The concentration of hexavalent chromium has been limited by the Water Quality Act of 1965 to five ppm or less in waters discharged into municipal sewage; the allowable concentration standard for drinking water is less than 0.05 ppm. Most Euglena gracilis survived a three hour exposure to a concentration of 1 mg/liter of chromium trioxide at room temperature, or 20C. When the flagellate were kept for one hour at 31.5C and exposed to chromium at room temperature they were as sensitive to 0.001 mg/liter as to 10 mg/liter. Simultaneous exposure to 31.5 plus or minus 0.5C and chromium concentrations down to 0.001 mg/liter resulted in less than 50% Euglena survival at the end of three hours. The most important results were the lasting effect of sublethal temperature and the lethal effect of chromium at concentrations lower than the 0.05 mg/liter legal standard for drinking water. (Davison-IPA)
W79-07770

DISTRIBUTION OF PHYTOPLANKTON IN FLORIDA LAKES,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
W. D. Taylor, F. A. Hiatt, S. C. Hern, J. W. Hilgert, and V. W. Lambou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 504, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-085, September 1978. 117 p, 4 tab, 11 ref, 1 append.

Descriptors: *Aquatic microbiology, *Phytoplankton, *Lakes, *Eutrophication, Outlets, Sewers, Environmental effects, Water quality, Florida, Water pollution effects, Distribution, Sampling, Nygaard's trophic indices, Palmer's organic pollution indices.

The species and abundance of phytoplankton in 40 lakes were sampled by the National Eutrophication Survey in Florida to ascertain the relationships between algal characteristics and trophic status of individual lakes. The lake selection criteria included: (1) lakes impacted by one or more municipal sewage treatment plant outfalls; (2) lakes of 40 hectares in size or larger; and (3) a mean hydraulic retention time of at least 30 days. Sampling sites were selected on the basis of available information on lake morphometry, potential major sources of nutrient input, and on-site judgement of the field limnologist. Results include the calculation of Nygarrd's Trophic State Index, Palmers Organic Pollution and species diversity and abundance indices. The computer generated appendix contains alphabetical phytoplankton lists, and also lists taxa without species names. (Davison-IPA)
W79-07771

RESULTS OF INVESTIGATIONS, T. E. MAXSON WTP AND SIGNIFICANT INDUSTRIAL CONTRIBUTORS, MEMPHIS, TENNESSEE,
For primary bibliographic entry see Field 5B.
W79-07788

THE SAN FRANCISCO BAY DELTA WASTEWATER AND RESIDUAL SOLIDS MANAGEMENT STUDY. VOLUME VI. TECHNICAL APPENDIX. THE PUBLIC HEALTH IMPLICATIONS OF LAND APPLICATION OF WASTEWATER AND RESIDUAL SOLIDS,
For primary bibliographic entry see Field 5E.
W79-07869

THE ECONOMIC IMPACT OF ALTERNATIVE CYANIDE STANDARDS IN ILLINOIS,
IIT Research Inst., Chicago, IL.
For primary bibliographic entry see Field 6E.
W79-07885

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

COAL MINE WATER POLLUTION - LEGAL AND REGULATORY ISSUES: A SURVEY,
For primary bibliographic entry see Field 5B.
W79-07887

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

GROUND AND SURFACE WATER IN NEW MEXICO: ARE THEY PROTECTED AGAINST URANIUM MINING AND MILLING,
For primary bibliographic entry see Field 6E.
W79-07896

ACID COAL MINE DRAINAGE: PAST POLLUTION AND CURRENT REGULATION,
West Virginia Univ., Morgantown. Coll. of Law.
For primary bibliographic entry see Field 6E.
W79-07905

COMPLETION OF SHELLED MICROZOOBENTHON SAMPLES,
Rice Univ., Houston, TX. Dept. of Geology.
R. E. Casey, C. Hueni, A. Leavesley, J. Gervitz, and R. Schwarzer.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 1-1 -1-82, 1979. 14 fig, 4 tab, 6 ref, append. AA550-CT6-17.

Descriptors: *Texas, Benthos, *Sediments, *Silting, *Sites, Water pollution effects, Drilling, Resources development, Baseline studies, *Outer Continental Shelf, *Foraminifera, Benthonic foraminifera, Bolivina lowmani, Ammonia beccarii, South Texas Outer Continental Shelf(STOCS).

The South Texas Outer Continental Shelf was sampled for living benthonic foraminiferans at 12 stations during three seasons in 1975. During 1976, 29 stations were sampled during three seasons and 10 of these stations were sampled during six monthly cruises. These samples were processed and living benthonic foraminiferans were picked, counted, identified and the data evaluated via cluster analysis and maps of density, diversity and richness. The significant findings include: the division of benthonic foraminiferans into groups or individuals characteristic of such features as nearshore-offshore, seasonality, regions of the shelf such as the modern mud blanket, etc. Findings that may prove useful for site evaluation or monitoring include: the use of Bolivina lowmani as a indicator of silting and bottom current movement, the use of Ammonia beccarii and other species to indicate perturbations in the water column and sediments, and the suggestion that the bank stations may represent a region very susceptible to man's activities. (Sinha-OEIS)
W79-07915

ANALYSES OF 1975-76 MICROZOOPLANKTON SAMPLES FROM TRANSECT II,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5G.
W79-07916

DETERMINATION OF AVERAGE DRY WEIGHTS OF IMPORTANT NEUSTON SPECIES COLLECTED IN 1976,
Texas A and M Univ., College Station.
J. H. Wormuth.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 3-1 - 3-37, 1979. 15 fig, 6 tab, 2 ref. AA550-CT6-17.

Descriptors: *Texas, *Ecology, *Plankton, *Biota, *Temporal distribution, *Spatial distribution, Baseline studies, Resources development, Water pollution effects, *Outer Continental Shelf, Diversity index, Species composition.

Dry weights per individual of a number of neuston taxa, considered to be ecologically important, were determined and then used in conjunction with the actual concentrations to give estimates of dry weights of the 1976 winter through April samples. In addition, analyses of variance were run to look at diel, seasonal and spatial variability; factor analysis was used to look at species groupings; comparisons of neuston and zooplankton data were made; and plots of seasonal variation of selected species means along Transect II were made. Groups of species which respond to the environment in similar ways are defined. The relationships of these groups to other parameters are not apparent in the 1976 data, but most of the other parameters were measured on different cruises than those on which the neuston samples were collected. (Sinha-OEIS)
W79-07917

BUREAU OF LAND MANAGEMENT SOUTH TEXAS OUTER CONTINENTAL SHELF REPORT OF CONSULTANCY ON BENTHIC ECOLOGY PROGRAMME - 22 AUGUST - 11 SEPTEMBER AND 24 OCTOBER - 5 NOVEMBER,
Marine Lab., Aberdeen (Scotland).
A. D. McIntyre.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 5-17 - 5-38, 1979. AA550-CT6-17.

Descriptors: *Texas, *Benthos, *Ecology, *Water pollution effects, Baseline studies, Environmental effects, Leases, Oil pollution, Monitoring, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

Work done to date in the benthos ecology programme is reviewed, giving particular attention to an evaluation of data collected during the first three years, and examining possible future developments. The aims are to achieve an understanding of how to assess and control the impact of petroleum exploitation and development in the STOCS area, and in particular to protect the living marine resources from deleterious effects, the overall aim being the general management of the OCS leasing programme. The research considered falls mainly into two parts - in general surveys of first the macrobenthic infauna and second the epifauna, but two related programmes, on regions of topographic highs and on the monitoring of drilling rig effects, are also included. (Sinha-OEIS)
W79-07918

MACROINVERTEBRATE STUDY,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
J. Holt, J. S. Holland, and P. Cotter.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 6-1 - 6-28, 1979. 18 fig, 1

tab. AA550-CL6-17.

Descriptors: *Texas, *Invertebrates, *Benthos, *Ecology, Baseline studies, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Population density, Spatial variation, Temporal variation, South Texas Outer Continental Shelf(STOCS).

Benthic invertebrate data from the STOCS were examined for spatial and temporal variation in abundance. Species which were characteristic of station groups and which showed strong variation in population density were studied. Samples collected in 1976 were retrieved and individuals sexed and measured. Length-frequency histograms of all species measured are presented. Variations in epifaunal abundance due to recruitment of young size classes into the study area were verified. Infaunal data analysis did not show seasonal peaks of reproduction possibly because generation time of infaunal organisms is short. Simple linear regressions of mean length of an epifaunal species against physical variables revealed significant correlations with depth, salinity and grain size parameters. Preliminary examination of non-linear, multi-variate analysis shows it to be a useful tool for explaining the distribution of a species. (Sinha-OEIS)
W79-07919

BIOMASS MEASUREMENTS OF BENTHIC INVERTEBRATES,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
J. S. Holland, J. Holt, P. J. Cotter, P. B. McDonald, and S. McBride.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 7-1 - 7-23, 1979. 8 tab, 7 ref. AA550-CT6-17.

Descriptors: *Texas, *Biomass, *Benthos, *Invertebrates, Baseline studies, Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Petroleum development, Biomass distribution, South Texas Outer Continental Shelf(STOCS).

Biomass, measures as wet weight, of 19 epifaunal species and 14 infaunal species for nine monthly and seasonal collections during 1976, was assayed. Distribution of biomass spatially and temporally was analyzed and regression of biomass on numbers of individual by species was obtained. Total sample biomass was distributed according to depth for both epifauna and infaunal organisms. Infauna exhibited a gradient in total biomass inversely proportioned to depth. Epifaunal biomass decreased precipitously in the deepest of the zones while remaining essentially the same in the two shallow zones. Analysis of variance on raw biomass and standing crop data showed no significant differences in total biomass with season or with transect. Biomass of individual species showed several interesting patterns. Infaunal species were either basically shallow-water species grading into deeper zones or the reverse. Epifaunal species exhibited several other biomass distribution patterns including apparent mid-depth species which exhibited decreased biomass in both shallower and deeper zones. Mean collection biomass exhibited possible recruitment periods for a limited number of species, with no significant pattern for most. (Sinha-OEIS)
W79-07920

ADDENDUM TO HISTOPATHOLOGY OF DEMERSAL FISHES. HISTOPATHOLOGY OF MICROPOGON UNDULATUS (ATLANTIC CROAKER) EXPOSED TO WATER SOLUBLE FRACTIONS OF SOUTH LOUISIANA CRUDE OIL,
Texas A and M Univ., College Station. Dept. of Veterinary Anatomy.
W. E. Haensly, and J. C. Eurell.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 8-1 - 8-10, 1979. 2 tab, 4 ref.

Descriptors: *Texas, *Pathology, *Fishes, *Water pollution effects, Baseline studies, Environmental effects, Resources development, *Outer Continental Shelf, *Crude oil, Demersal fishes, Atlantic croaker, Micropogon undulatus, South Texas Outer Continental Shelf(STOCS).

Histopathologic analyses of approximately 100 Micropogon undulatus (Atlantic croaker) exposed to water soluble fractions of South Louisiana crude oil were made. Five fish were exposed to two solutions (5 and 10% of a stock solution) for 1, 3, 7, 14 and 21 days. Samples of liver, kidney, heart, skeletal muscle, stomach, gonad and gill were collected following the various periods of exposure. Most of the organ samples obtained from fish exposed to varying concentrations of water soluble fractions of South Louisiana crude oil did not show lesions that could be attributed to the oil. Two of the organs, gill epithelium and liver, and possibly a third organ, the subcutaneous areas, did show a response to the crude oil. The fact that some organs did not demonstrate a response and that others showed a minimal response suggests that the lengths of exposure, the concentrations used, or both exposure and concentrations, were too low to permit severe lesions to occur. (Sinha-OEIS)
W79-07921

AN INTENSIVE STUDY OF THE HEAVY HYDROCARBONS IN THE SUSPENDED PARTICULATE MATTER OF SEAWATER,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5B.
W79-07922

FATE OF PETROLEUM-DERIVED AROMATIC COMPOUNDS IN SEAWATER HELD IN OUTDOOR TANKS,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
J. K. Winters.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 12-1 - 12-77, 1979. 20 fig, 29 tab, 4 ref. CC550-CT6-17.

Descriptors: *Texas, *Oil spills, *Aromatic compounds, Water pollution effects, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, *Petroleum development, Alkanes, South Texas Outer Continental Shelf(STOCS).

Two simulated oil spills (300 and 100 PPM) were conducted in 7000 liter outdoor tanks. A mixture of aromatic compounds was added to a tank in a third experiment. Dissolved and particulate fractions of seawater were analyzed by gas chromatography and combined gas chromatography-mass spectrometry. Results showed that the concentration of petroleum derived alkanes was approximately ten times greater in particulate fractions. Aromatics were generally at least five times more concentrated in dissolved fractions. Aromatic compounds were partitioned between dissolved and particulate fractions with parent and mono-methyl compounds enriched in dissolved fractions while more highly methylated compounds were enriched in particulate fractions. (Sinha-OEIS)
W79-07923

DEVELOPMENT OF MINI-COMPUTER PROGRAMMING TO AID IN INTERPRETATION OF MASS SPECTRAL DATA,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5A.
W79-07924

DEVELOPMENT OF A CHELATING/CO-PRECIPITATION PROCEDURE FOR MATRIX-FREE ANALYSIS OF VARIOUS METALS IN ORGANISMS FROM THE SOUTH TEXAS OCS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY,
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W79-07925

BIOLOGICAL CHARACTERIZATION OF THE NEPHELOID LAYER,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
D. Kamykowski, J. Batterton, J. Bird, R. Jordan, and S. Milton.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-7, to the Bureau of Land Management, p 15-1 - 15-86, 1979. 29 fig, 15 ref, 3 append. CC550-CT6-17.

Descriptors: *Texas, *Phytoplankton, *Biomass, *Water pollution effects, Oil pollution, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, *Nepheloid layer, Species composition, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A single station (near STOCS 4/II) was sampled for 24 hour periods on 29-30 June, 24-25 July, 25-26 September and 8-9 November 1978. Samples surveyed turbidity, light transmission, temperature, salinity, plant nutrients, plant biomass, species abundances, and near bottom 14C uptake. A variable nepheloid layer was encountered during each cruise; only the first two cruises had associated phytoplankton abundances. These phytoplankton accumulations were composed of both pelagic and benthic species. Net 14C uptake was detected within these layers under in situ conditions. Evidence suggests that this layer may be especially vulnerable to energy related activities. It is speculated that oil introduced into the near bottom layer probably will affect the species composition and net production of the phytoplankton community either through direct toxicity or through detrimental effects on light conditions, nutrient conditions or grazers. The ecosystem impact of changes in this phytoplankton reservoir will depend on the alternate choices available to grazers. (Sinha-OEIS)
W79-07926

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME III - APPENDICES A-F.
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 823 p. AA550-CT7-11.

Descriptors: *Texas, *Hydrography, *Data collections, Zooplankton, Biota, Metals, Sediments, Oil pollution, Water pollution effects, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. This, the third volume, contains appendices A through F, and consists of data resulting from the following projects: (A) Hydrographic Project: Calibrated temperature and salinity values from the 1977 sampling program and computed hydrographic variables; (B) Low-molecular-weight hydrocarbon and hydrographic project; (C) High-molecular-weight hydrocarbons in zooplankton, sediment and water; (D) Heavy molecular weight hydrocarbons in macroepifauna and macronekton; (E) Trace metals project; and (F) Sediment Texture. (Sinha-OEIS)
W79-07927

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME IV - APPENDICES G - I,

Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 567 p. AA550-CT7-11.

Descriptors: *Texas, *Data collections, *Bacteria, *Benthos, *Water quality, Fungi, Baseline studied, Water pollution effects, Oil pollution, Environmental effects, Resources development, *Outer Continental Shelf, Petroleum development, Oil transport, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. The fourth volume of six, contains appendices G through I, and consists of data resulting from the following projects: (G) Water column bacteriology; (H); Water column and benthic microbiology:mycology; and (I) Benthic bacteriology. (Sinha-OEIS)
W79-07928

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME V - APPENDICES J - M,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 804 p. AA550-CT7-11.

Descriptors: *Texas, *Phytoplankton, *Data collections, *Plankton, *Protozoa, *Zooplankton, *Productivity, Water pollution effects, Environmental effects, Baseline studies, Oil pollution, Resources development, *Outer Continental Shelf, Petroleum development, Oil transport, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. The fifth volume of six, contains appendices J through M, and consists of data resulting from the following projects: (J) Phytoplankton and productivity; (K) Shelled microzooplankton and general microplankton; (L) Ciliated protozoa; and (M) Zooplankton. (Sinha-OEIS)
W79-07929

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME VI - APPENDICES N - S,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
Final Report 1977 to the Bureau of Land Management, January 15, 1979. 600 p. AA550-CT7-11.

Descriptors: *Texas, *Biota, *Data collections, *Pathology, *Invertebrates, Water pollution effects, Baseline studies, Resources development, Oil pollution, Environmental effects, Fishes, *Outer Continental Shelf, Petroleum development, South Texas Outer Continental Shelf(STOCS).

A study of the South Texas Outer Continental Shelf (STOCS) was conducted on behalf of the U.S. Bureau of Land Management. The sixth volume of the series, contains appendices N through S, and consists of data resulting from the following projects: (N) Neuston project; (O) Meiofauna project; (P) Benthic invertebrates: macroinfauna and epipauna; (Q) Demersal fishes; (R) Histopathology of demersal fishes; and (S) Histopathology of invertebrate epifauna. (Sinha-OEIS)
W79-07930

FEDERAL ROLE IN OCS OIL AND GAS DEVELOPMENT.
Office of Technology Assessment, Washington, DC.
Staff Paper, May 1977. 22 p.

Descriptors: *Leases, *Resources development, *Federal government, *Baseline studies, Pollution abatement, Environmental effects, Water pollution effects, Oil pollution, United States, *Outer Continental Shelf, Petroleum development.

The numerous Federal Government related activities which make up the entire OCS leasing and regulating process are set forth as well as estimates for each step. One chart provides an overview of the process in its entirety. Detailed charts describing the process step-by-step are also provided. Finally a bar chart is provided to show the amount of time required by both Government and industry to proceed through the various stages of the OCS oil and gas development process. Separate 'timelines' are provided for both established and frontier areas. Baseline studies are conducted in frontier areas to establish an environmental benchmark to permit continued monitoring after the sale during drilling and production to detect possible adverse effects from these operations. If such adverse effects are detected, additional regulations would be adopted to reduce or eliminate them. Studies cover data on geology, geophysics, biological environment, oceanography and meteorology associated with a particular region where offshore leasing may take place. These studies include original research as well as an analysis of existing information. (Sinha-OEIS)
W79-07931

STUDY DESIGN FOR RESOURCE MANAGEMENT DECISIONS: OCS OIL AND GAS DEVELOPMENT AND THE ENVIRONMENT.
Bureau of Land Management, Washington, DC.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $0.00. Stock No. 024-011-00100-0. October 1978. 111 p, 3 fig, 4 tab, 10 ref, 10 append.

Descriptors: *United States, *Resources development, *Water pollution effects, *Environmental effects, Pollution abatement, Gases, Oil spills, Water resources, Planning, Decision making, *Outer Continental Shelf, Petroleum development, Resources management.

This document is an updated statement of the program design for the Bureau of Land Management's (BLM) Outer Continental Shelf (OCS) Environmental Studies Program. The analyses contained in this document are useful for delineating information needs and for establishing program direction, but these are only examples and are not intended to be exhaustive. Chapters three and four and a number of the appendices show a few of the ways in which public issues for a given OCS area can be determined and used to define studies that can provide timely and useful information to the decisionmaker. It is hoped that this document represents a clear statement of the structure and function of the OCS environmental studies program as it exists now, and provides a framework in which changes can be readily accommodated on a regular basis. A glossary of terminology has been provided. (Sinha-OEIS)
W79-07932

THE MICROFOULING PROBLEM AND THE FUTURE OF THE OCEAN THERMAL ENERGY CONVERSION (OTEC) PROGRAM,
Columbia Univ., New York. Dept. of Biological Sciences.
W. A. Corpe.
Marine Technology Society Journal, Vol. 13, No. 1, p 21-25, February-March, 1979. 1 tab, 25 ref.

Descriptors: *Resources development, *Energy conversion, *Fouling, *Sea water, Heat exchangers, Films, Slime, Environmental effects, Water pollution, Electric power, Water pollution effects, *Outer Continental Shelf, *Ocean Thermal Energy Conversion(OTEC).

The Ocean Thermal Energy Conversion (OTEC) concept is looked upon as a potentially important, renewable source of electric power for the future, deserving of study and possible development. The temperature difference between warm surface water and cold deep water at most suitable tropical or subtropical oceanic sites is only about 20 degrees K, so the thermal resistance between seawater and working fluid must be as low as possible so as not to compromise the technical viability of the system. Microfouling in the form of a 'slime layer' invariably develops on all solid surfaces exposed to seawater. Such films significantly affect the performance of heat exchanges by acting as insulators. Some aspects of marine microfouling are discussed and some views are presented about (a) what kind of research effort in microfouling must be undertaken if progress in OTEC development is ultimately to be realized, and (b) what considerations ought to be taken into account when establishing research priorities. (Sinha-OEIS)
W79-07933

OCS DEVELOPMENT AND COMMERCIAL AND RECREATIONAL FISHING,
Resources for the Future, Inc., Washington, DC.
E. A. Wilman.
Coastal Zone Management Journal, Vol. 5, No. 3, p 211-230, 1979.

Descriptors: *Resources development, *Fisheries, *Oil spills, *Leases, Environmental effects, Water pollution effects, Fishing grounds, Economics, *Outer Continental Shelf, Petroleum development, Commercial fisheries, Recreational fisheries.

As the controversy over Outer Continental Shelf (OCS) oil and gas leasing continues, with environmentalists and fishermen seeking to block or delay leasing decisions that they think will adversely affect their interests, the need for better estimates of the environmental costs associated with OCS development becomes increasingly apparent. Although high degrees of precision in such estimates may never be economic, let alone feasible, better knowledge would reduce the uncertainty surrounding the magnitude of such costs, and would make it easier to come to grips with the problem and reduce, if not resolve, the controversy. (Sinha-OEIS)
W79-07934

ROOTED AQUATIC PLANTS,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
For primary bibliographic entry see Field 5A.
W79-07965

BENTHIC MACROINVERTEBRATES OF THE FRESHWATER POTOMAC,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
G. H. Harmon.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2. In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 29-35, 2 fig, 1 tab, 28 ref.

Descriptors: *Benthic fauna, *Invertebrates, *Aquatic animals, *Potomac River Basin, *Water quality, *Bioindicators, *Water pollution, Water pollution sources, Acid mine water, Sampling, Monitoring, Ecology.

Potomac River benthic invertebrates are sampled in a program conducted by the Maryland Water Resources Administration to provide information applicable to the assessment of trends in water quality. As part of the Baseline Water Quality Monitoring Network (BWQMN) established by the Interstate Commission on the Potomac River Basin, the statewide program consists of 15 sampling locations. Results are reported for each of the 10 mainstream stations above Washington which have been sampled at least once during the past three years. These results show that the benthic macroinvertebrate communities of the Upper North Branch of the Potomac River are impoverished, indicating severely degraded water quality primarily caused by acid mine wastes. The nea annihilation of the aquatic communities including fish and most aquatic plants, in addition to the macroinvertebrates, is attributed to the acid mine waters. At Paw Paw and Hancock good-to-excellent water quality is indicated by the diverse benthic communities. A downward trend in water quality and benthic community diversity in the Shepherdstown to Little Falls region is attributed to point discharges and nonpoint runoff. The

impact of the environmental stresses created by man and nature in the basin is generally reflected by the macroinvertebrate communities. Approximately 200 macroinvertebrate species have been identified in the freshwater Potomac. (Davison-IPA)
W79-07966

BENTHIC MACROINVERTEBRATES OF THE SHENANDOAH BASIN,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
H. H. Seagle, Jr., and A. C. Hendricks.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 36-43, 5 fig, 2 tab, 22 ref.

Descriptors: *Benthos, *Invertebrates, *Bioindicators, *Environmental effects, Systematics, Aquatic insects, Shenandoah River basin.

Semi-quantitative samples of benthic macroinvertebrates were taken at four stations in the Shenandoah basin to determine the meaningful attributes of the biotic community which could be used as indicators of environmental changes. A total of 191 taxa representing 78 families and six phyla of macroinvertebrates have been collected in the basin. The most diverse, the phylum Arthropoda, represented 84.2% of the taxa. The aquatic insect orders Trichoptera, Coleoptera, Ephemeroptera, and Diptera were the most abundant organisms. Of the four genera of aquatic moths reported, only Paragyractis is believed to actually occur in the basin. The four organisms being reported from Virginia for the first time are Ephemera varia, Ephoron leukon, Potamanthus myops, and P. Walkeri. (Davison-IPA)
W79-07967

FISHES OF THE APPALACHIAN REGION OF MARYLAND,
Maryland Dept. of Natural Resources, Cumberland. Regional Service Center.
R. M. Davis.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 59-65, 1 fig, 2 tab, 19 ref.

Descriptors: *Fish populations, *Appalachian Mountain Region(Maryland), *Acid mine water, Potomac River, Tributaries, Drainage patterns, Water pollution effects, Water quality, Fish migration, Fish establishment, Aquatic habitats, Aquatic environment.

Fish populations of the Potomac River are discussed for the portion of the river from its headwaters near Kempton, Maryland, to Hancock, Maryland, and associated Potomac River tributaries. Acid mine drainage adversely affects the water quality in this region of Maryland, and in turn affects the fish populations of the Potomac River. Because it is extremely toxic to all forms of aquatic life, acid mine drainage, left undiluted, may destroy biological activity for many miles downstream from its discharge point. Past and current studies concerning the Potomac River water quality are cited. Fish samples were taken from seven stations on the North Branch, Potomac River, from three stations on the Potomac River Main Stem, and from 35 tributary stations. No fish were found at the three uppermost stations on the North Branch and 14 tributary stations due to heavy acid mine drainage. Water quality is extremely poor from Kempton to Luke, and remains poor from Luke to McCoole where three species of minnows were collected. Just upstream from Cumberland seven species of fish were collected, indicating some improvement of water quality. Gradual improvement of water quality was noted from Cumberland to Little Orleans, Maryland; the slight deterioration at Hancock was due to local waste water discharge. Water quality was sufficiently improved at Westernport and Keyser to allow 22 species of fish to become established. A total of 42 different species of fishes were collected at the various stations. Only three to nine species of fish occur where streams receive intermittent-to-small amounts of acid mine drainage; streams with no acid mine drainage had three to 24 species in more abundant populations. (Davison-IPA)
W79-07970

FISHERY RESOURCES OF THE SHENANDOAH VALLEY,
Virginia Commission of Game and Inland Fisheries, Charlottesville.
J. Kauffman.
Interstate Commission on the Potomac River Basin, Rockville, MD. Technical Publication 78-2.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 66-69, 5 fig, 1 tab, 8 ref.

Descriptors: *Fisheries, *Fish populations, *Fish establishment, *Aquatic habitats, *Aquatic life, *Aquatic environment, Water pollution effects, Fish food organisms, Water quality, Phosphate, Nitrate, Phytoplankton, Agricultural runoff, Creel census, Shenandoah River(Virginia).

The Shenandoah is the most heavily fished stream in Virginia, and has an estimated economic expenditure value of 2,718/hectare a year. Creel surveys conducted on the South Fork of the Shenandoah from 1964 to 1968 and from 1973 to 1975 showed a decline in catches of channel catfish, panfish, and largemouth bass; smallmouth bass and rock bass catches remained stable. Increased nutrient loads resulting from changed land use practices have caused the aquatic plant community to change from a macrophyte to a phytoplankton food chain. This may have caused a change from a smallmouth to largemouth bass community in intermediate habitats. The increased human populations, industry, and agricultural production which resulted in environmental changes are reflected in changes in the Shenandoah River fishery. (Davison-IPA)
W79-07971

THE FISHERY OF THE PIEDMONT POTOMAC,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
A. Dietemann, and A. Sanderson, Jr.
Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 70-75, 3 fig, 1 tab, 32 ref.

Descriptors: *Fisheries, *Fish management, *Fish populations, *Fish conservation, *Fish establishment, *Spawning, Fish passages, Anadromous fish, Ecology, Aquatic habitats, Aquatic environment, Water quality control, Water utilization, Water pollution, Water pollution effects, Potomac River(Maryland).

Although the fishery of the Piedmont Potomac has declined during the past 10 years, the River and its tributaries from the Monocacy to below Little Falls still support a fair resident fishery; there is great spawning potential for anadromous fish in the river below Little Falls. Overfishing, lack of effective fish passages at water supply intakes, flow reduction caused by increased withdrawals, sediment pollution, and stormwater containing contaminants are all probable factors contributing to the decline. A total of 63 fish species are reported for this area of the Potomac River, and of these, four not reported for several years may be extirpated from the Piedmont Potomac. Limiting water supply withdrawals and problems of water quality control associated with urbanization and agricultural runoff are examined. It is concluded that fish life in the Piedmont Potomac is still a diverse and admirable resource. Specific suggestions are made for the protection and enhancement of this resource. (Davison-IPA)
W79-07972

THE EFFECTS OF THERMAL EFFLUENTS AND SEDIMENTS ON THE INSECT FAUNA,
Academy of Natural Sciences of Philadelphia, PA. Div. of Limnology and Ecology.
S. S. Roback.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 119-123, 7 fig. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Water pollution effects, *Aquatic insects, *Aquatic habitats, *Aquatic environment, Electric generators, Environmental effects, Thermal pollution, Sediments, Deposition(Sediments), River flow, Turbidity, Silting, Potomac River(Maryland), Monocacy River(Maryland), Whites Ferry(Maryland), Point of Rocks(Maryland).

The Potomac River was surveyed at four stations from Point of Rocks to Whites Ferry from 1956 to 1972. The stations are located above and below the Potomac Electric Power Company (Pepco) generating plant which is situated at the confluence of the Potomac and Monocacy Rivers. Station 2, the first below the plant, is split with the left bank (2L) receiving the heated plant effluent; the right bank (2R) is free of heated water, except under very unusual flow conditions. High-water flow dilutes the heated effluent and also concentrates and holds the silt from the Monocacy along the left bank. Station 2L and the left channel of station 3 monitor the effects of silt form urbanization and agriulture which flow from the Monocacy into the Potomac. The fluctuations in the total insect fauna at each station are charted with the starting dates of operation for the different Pepco generating units. Species number declined at stations 1, 2L and 3 when unit 1 started up. When units 2 and 3 became operational no disturbances were noted. At the beginning of the survey in 1975, a range of 54 to 104 species of insects were noted; by 1975 these numbers declined to a range of 47 to 76 species. This decline in the insect fauna is attributed to increased nonpoint discharges. Fluctuations are charted for the following insect families found in this study: Gomphidae (Odonata: Anisoptera), Heptageniidae (Ephemeroptera), Perlidae (Plecoptera), Elimidae (Coleoptera), and Hydrosychidae (Trichoptera). (Davison-IPA)
W79-07980

THE CHANGING MOLLUSCAN COMMUNITY,
Academy of Natural Sciences of Philadelphia, PA. Div. of Limnology and Ecology.
S. Fuller.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 124-131, 1 tab, 62 ref.

Descriptors: *Water pollution effects, *Mollusks, *Thermal pollution, *Sedimentation, *Animal populations, Ecosystems, Ecological distribution, Aquatic invertebrates, Benthic fauna, Mussels, Effluents, Gastropods, Snails, Toxins, Potomac River, Montgomery County(Maryland).

An environmental survey of the middle Potomac River was conducted from 1956 to 1976 on behalf of the Potomac Electric Power Company (Pepco) and its steam electric station at Dickerson, Montgomery County, Maryland. Mollusks were selected for study because they are a predominant element of the fresh-water macrobenthos, and are widely adaptable to environmental changes. In addition to studying the changes in the mollusk population, the effects of thermal effluents on these invertebrates were examined. Information concerning the numbers of animals present, the location and state of the environment, symbiosis, and condition of the animal is presented for numerous bivalves and gastropods. The severe decline of these populations over the years is attributed to sedimen-

ation, heightened water temperature, symbiotic elationships, and toxins. Significant changes ocurred in 1967 or 1968, and most of the affected nollusks were extirpated or their populations were liminished below recruitment level. At present the nadequate environmental conditions persisting consist of sedimentation, adverse water temperaure, the onslaught of exotic organisms, and the ffects of toxic pollutants. Thermal effects are local nd no longer affect the composition of the comnunity which has been reduced to a core of speies notoriously tolerant of environmental disturbances. (Davison-IPA)
W79-07981

EFFECTS OF THERMAL DISCHARGES ON FRESHWATER FISHES,
Ichthyological Associates, Inc., Middletown, DE. Experimental Studies.
J. W. Meldrin, and S. Peterson.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 132-136, 5 fig, 32 ref. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Water pollution effects, *Thermal pollution, *Fresh water fish, *Water temperature, *Environmental effects, Entrainment, Thermal powerplants, Ecology, Fish management, Fish behavior, Fish physiology, Aquatic environment.

The use of water by steam electric power generating stations to cool their condensers results in a thermal discharge, the effects of which vary with the type of fish and how that species exploits the environment of that site. The degree of ecological significance of a particular effect is site-specific, and must be evaluated consistant with the ecological potential of the water body. Results of laboratory experiments show that fish have preferred temperatures, i.e., they will avoid temperatures too high or too low. This response varies with the season, species, ambient temperature of the receiving water, and the temperature of the thermal discharge. Light level size also influence avoidance temperature and preferred temperature. Fish seem to prefer thermal plume during the colder months. Crowding resulted in an increased incidence of disease, starvation, and poor condition in some species, but not others. Sudden temperature decreases are of more concern than upped lethal temperatures which will be avoided. Mortalities can occur during the colder seasons if the thermal discharge stops, or if the plume temperatures drop below the temperature tolerance of the species. The effects of secondary (or plume) entrainment on fish eggs and prolarvae are small compared to the other effects. (Davison-IPA)
W79-07982

WATER QUALITY EFFORTS BY CHEMICAL INDUSTRIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W79-07984

IMPACT OF WASTEWATER TREATMENT PLANT DISCHARGES,
Maryland Univ., College Park. Inland Environmental Lab.
C-f. Tsai.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 147-150, 5 fig, 33 ref.

Descriptors: *Sewage effluents, *Environmental effects, *Water pollution effects, Ecosystems, *Aquatic habitats, Fish behavior, Spawning, Benthos, Waste treatment, Water pollution sources, Waste disposal, Sewers, Outfalls, Treatment facilities, Water quality control, Water pollution treatment, Chlorination, Nitrates, Phosphates, Eutrophication.

Chemical composition of sewage treatment plant effluents varies from plant to plant, depending on the sources of sewage, the degree of treatment, and the chemicals added during treatment. The impact of these effluents differs from one receiving stream to another, according to the quality and quantity of the effluent, and the physical and chemical condition of the stream. Sewage effluents often toxic, damage aquatic life through direct toxication. The sludges contained in these effluents are also damaging in that turbidity is increased, fish may receive abrasive injuries and clogged gills, bottom organisms are reduced and modified, and spawning grounds are destroyed. Phosphates and nitrates, the organic nutrients in sewage effluents, increase primary productivity and are beneficial in amounts which can be assimilated into the food chain. Excessive amounts of the nutrients result in water deoxygenation, algal bloom, growth of molds and bacteria, and eutrophication. Events occurring when improperly treated or raw sewage is discharged to a receiving stream are summarized; the effects of proper and improper chlorination are discussed; four types of plants are described; and four types of sewage outfall locations are examined. Because they contain two major resources, water and nutrients, sewage effluents can be reclaimed by crop irrigation, and used as fertilizer, soil conditioners, and compost. It is concluded that the impact of sewage effluents can be damaging or beneficial, depending on the type of sewage produced, how it is treated, and the manner of its disposal. (Davison-IPA)
W79-07985

5D. Waste Treatment Processes

AEROBIC DIGESTION OF WASTE ACTIVATED SLUDGE,
Alley (E. Roberts) and Associates, Brentwood, TN.
C. S. Reece, R. E. Roper, Jr., and C. P. L. Grady, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers. Vol. 105, No. EE2. p 261-272, April 1979. 5 fig, 3 tab, 20 ref, 2 append. OWRT A-033-IND (5).

Descriptors: *Activated sludge, *Aerobic treatment, Sludge, Sludge digestion, Suspended solids.

Activated sludge that had been grown on a completely soluble wastewater in a pilot plant was subjected to aerobic digestion in batch, lab-scale reactors. During the course of digestion, destruction of nonvolatile solids occurred so that it was preferable to express the kinetics of digestion upon the loss of total suspended solids rather than volatile suspended solids. The first-order rate constant for the destruction of degradable suspended solids was found to be unaffected by the solids retention time (SRT) at which the activated sludge had been grown, whereas the nondegradable fraction of the activated sludge was found to increase as the SRT increased.
W79-07581

EXPERIMENTAL DEGRADATION OF CRUDE OIL BY MARINE BACTERIA,
Kobe Univ. of Mercantile Marine (Japan). Research Inst. of Marine Cargo Transportation.
For primary bibliographic entry see Field 5B.
W79-07594

RESIDUAL HEAVY METAL REMOVAL BY AN ALGAE-INTERMITTENT SAND FILTRATION SYSTEM,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5C.
W79-07638

NITROGEN AND PHOSPHORUS REMOVAL FROM SEWAGE EFFLUENT WITH HIGH SALINITY BY CHORELLA SALINA,
Chinese Univ. of Hong Kong. Dept. of Biology.
K-Y. Chan, K. H. Wong, and P. K. Wong.
Environmental Pollution, Vol. 18, p 139-146, 1979. 3 fig, 1 tab, 34 ref.

Descriptors: *Microbial degradation, *Chlorella, *Sewage effluent, Salinity, Nitrogen, Phosphorus, Ammonia, Domestic wastes, Waste water treatment, Phosphates, Nitrates, Absorption, Chlorophyta, Secondary treatment, Nutrients, Growth rates.

Cells of Chlorella salina CU1 are able to grow well in domestic sewage effluent having salinities as high as 16 ppt. By using controlled C. salina CU1 cultures, it is possible to remove the nitrogen and phosphorus from the sewage effluent before it is discharged into marine coastal water. With a retention time of 8 days, 86% to 100% NH3-N, 98% NO3-N and 98% PO4-P are removed from the sewage effluent under laboratory conditions. It is also found that cells of C. salina CU1 prefer ammonia to nitrates as nitrogen source. Uptake of nitrates by the cells occurs only after the ammonia in the sewage effluent has been reduced to levels below 0.5 ppm. Ammonia at higher concentrations completely inhibits the nitrate uptake by the algal cells. Since cells of C. salina CU1 have a high protein content (44%), it is proposed that this unicellular green alga can be used to serve the dual function of wastewater purification and waste recycling through the production of algal protein from sewage effluent having high salinities. (Deal-EIS)
W79-07643

ACUTE TOXICITY OF DECHLORINATED DDT, CHLORDANE AND LINDANE TO BLUEGILL (LEPOMIS MACROCHIRUS) AND DAPHNIA MAGNA,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5C.
W79-07671

THE USE OF EVAPOTRANSPIRATION AS A MEANS OF WASTEWATER DISPOSAL,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
D. W. Weeter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 767, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, Tennessee University, Research Report No. 70, May 1979. 136 p, 15 fig, 26 tab, 63 ref, 2 append. OWRT A-053-TENN(1). 14-34-0001-8045.

Descriptors: *Waste water treatment, *Evapotranspiration, *Effluents, Septic tanks, Aerobic treatment, Infiltration rates, Flow rate, Trace elements, Absorption, Methodology, Costs.

A laboratory study, mathematical models, and a literature search were employed to determine the applicability of evapotranspiration to treat on-site disposal of septic tank effluent and aerobically treated effluent. The relative fate of some trace metals within the evapotranspiration bed was determined in the laboratory. Mathematical models were employed in determining the evapotranspiration rates (outflow) and the infiltration rates (inflow) of the proposed evapotranspiration bed. A literature search related soil-groundwater parameters to the inflow-outflow rates and attempted to determine the effective life of the system. Results of the study show that evapotranspiration rates of aerobically digested water are equal to the rates for septic tank effluent; that evapotranspiration is independent of the dry plant matter produced; and the two feed solutions showed equal metal uptake rates. Life expectancy data were inconclusive. A methodology was proposed for an evapotranspiration waste water disposal bed design, but the current literature allowed only an estimate as to the range of bed sizes. It is concluded that the cost of this method is economically justifiable in certain circumstances. (Davison-IPA)
W79-07772

MANAGEMENT OF SMALL WASTE FLOWS.
Wisconsin Univ.-Madison.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB-286 560, Price codes: A99 in paper copy, A01 in microfiche. Report EPA-600/2-78-173, 1978. 807 p, 235 fig, 251 tab, 411 ref, 5 append.

Descriptors: *On-site collections, *Domestic wastes, *Soil investigations, *Treatment, *Septic tanks, Infiltration, Clogging, Aerobic treatment, Filtration, Flow characteristics, Hydraulic conductivity, Nutrient removal, On-site tests, Waste water treatment, Wisconsin.

A seven-year research project was conducted to conceive, evaluate and develop satisfactory methods of on-site treatment and disposal of waste waters. The study included characterization of household and commercial waste waters, assessment of waste water treatment alternatives dependent or independent of soil design, management of on-site disposal systems, and institutional and regulatory control of on-site systems. Waste water characteristics and flow data were monitored at 11 rural Wisconsin homes over a period of 434 days; the quality of the waste water was monitored for 35 days at four of the sites. Four sand filters, 11 septic tanks, 11 aerobic units, and a chemical unit were evaluated at 10 field sites and in one controlled system with a waste water simulator. Soils were evaluated as a treatment and disposal medium, and for capabilities for removing bacteria, viruses, and nutrients from waste water under different loadings and soil temperatures. The infiltration rates through biologically clogged soils were calculated; methods for reducing clogging in soils were investigated. Field methods of measuring soil hydraulic conductivity were developed and results of the investigations were utilized to improve the design, installation, and operation of both conventional and alternative soil absorption systems. Institutional control strategies for on-site waste management were discussed. (Lisk-FRC)
W79-07774

DEMONSTRATION OF A LEACHATE TREATMENT PLANT,
Applied Technology Associates, Philadelphia, PA.
R. L. Steiner, J. E. Keenan, and A. A. Fungaroli.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 502, Price codes: A04 in paper copy, A01 in microfiche. Report, 1977. 67 p, 8 fig, 18 tab, 63 ref, 1 append.

Descriptors: *Landfills, *Leachate, *Chemical precipitation, *Activated sludge, *Neutralization, Nutrients, Linings, Lime, Waste water treatment, Municipal wastes.

Chemical-physical and biological treatment is provided in a demonstration sanitary landfill leachate treatment plant. The physical-chemical treatments include lime precipitation, sedimentation, and air stripping. These processes remove heavy metals, ammonia, and organic materials; neutralization and nutrient supplement with sulfuric acid and phosphoric acid, respectively, enhanced the subsequent biological treatment. Activated sludge is used in the biological treatment. Processing of the leachate from a lined landfill permits discharge of the effluent into the Delaware River. (Lisk-FRC)
W79-07775

TREATMENT AND STABILIZATION OF POLYCHLORINATED BIPHENYLS (PCBS) CONTAMINATED WATER AND WASTE OIL-A CASE STUDY. WHITEHOUSE, FLORIDA,
Environmental Protection Agency, Atlanta, GA. Region IV.
A. Smith, F. Stroud, and R. Wilkerson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 842, Price codes: A03 in paper copy, A01 in microfiche. Report, 1977. 33 p, 19 fig, 4 tab, 1 append.

Descriptors: *Oil wastes, *Activated carbon, *Adsorption, *Filtration, *Polychlorinated biphenyls, Heavy metals, Settling basins, Oily water, Sludge, Treatment facilities, Waste water treatment, Industrial wastes, Florida.

An on-site treatment process was developed for six abandoned waste oil pits in Florida which contained high levels of polychlorinated biphenyls (PCB). Sampling of the ponds, which had a total surface area of about 5 acres and depths ranging from 5-15 ft, indicated they contained a bottom layer of thick oily sludge underlaying a layer of water and covered by a layer of oil. Pit pH was 1.0, permitting the PCBs to be soluble in the oil/water mixture. PCB concentrations in the sludge samples ranged 8.7-23.3 ppm and significant levels of copper, lead, zinc, cadmium, and chromium were measured. To reduce PCB levels to within 1 ppb, activated carbon was selected. Because adsorption columns were not considered practical in this instance, a powdered activated carbon adsorption system was developed which incorporated a collection sump, a carbon mixing chamber, a sedimentation basin, and a sand filter. The sump drained the pits into the mixing chamber where carbon was added at 27 ppm to the influent. The carbon-PCB sludge was then transferred to a 22,500 gal stabilization basin for at least 6.25 hrs, followed by filtration through a sand filter. The treated effluent was discharged into the St. Johns River. (Lisk-FRC)
W79-07778

LINER MATERIALS EXPOSED TO HAZARDOUS AND TOXIC SLUDGES,
Matrecon, Inc., Oakland, CA.
For primary bibliographic entry see Field 8G.
W79-07779

ASSESSMENT IN INDUSTRIAL HAZARDOUS WASTE MANAGEMENT PETROLEUM RE-REFINING INDUSTRY,
For primary bibliographic entry see Field 5E.
W79-07781

CLOSED LOOP SYSTEM FOR THE TREATMENT OF WASTE PICKLE LIQUOR,
Crown Chemical Co., Inc., Indianapolis, IN.
J. C. Peterson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 090, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-127, 1977. 60 p, 18 fig, 12 tab, 6 ref.

Descriptors: *Acid streams, *Iron oxides, *Crystallization, *Ion exchange, *Oxidation, Hydrolysis, Recycling, Chemical wastes, Resins, Waste water treatment, Industrial wastes.

The conversion of ferrous sulfate, produced by the low temperature crystallization from sulfuric acid waste pickle liquor generated by acid-cleaning steel surfaces, to marketable ferric oxide in a closed-loop system was demonstrated. The closed-loop conversion system contains a crystallizer, an ion exchange unit, an oxidizer, and a hydrolyzer. All acids are recycled with the ferrous sulfate consumed and ferric oxide produced. In the continuous ion exchange unit, the ferrous sulfate solution is contacted with hydrogen ion exchange resin, resulting in 90% removal of ferrous ion. The system produced about 11-15% by weight sulfuric acid for recycle to the pickling process. Regeneration of the resin with 4M HNO_3 produced a ferrous-ferric nitrate solution which was subsequently heated to 180C and contacted with air for complete oxidation to the ferric phase and to oxidize NO_2 to HNO_3. Hydrolysis of this nitrate solution in a continuous coil autoclave at 205C generated ferric oxide and HNO_3. This process produced about 20% by weight HNO_3 which was recycled to the ion exchange unit. The ferric oxide was about 99% pure after drying and had an estimated market value of $0.10-0.80/kg. (Lisk-FRC)
W79-07783

REDUCTIONS IN WATER CONSUMPTION AND FLOW OF SEWAGE - REPORT TO CONGRESS.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5F.
W79-07785

DEMONSTRATION OF ULTRAFILTRATION AND CARBON ADSORPTION FOR TREATMENT OF INDUSTRIAL LAUNDERING WASTEWATER,
Abcor, Inc., Wilmington, MA. Walden Div.
M. H. Kleper, R. L. Goldsmith, and A. Z. Gollan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 830, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-177, 1978. 109 p, 16 fig, 26 tab, 8 ref, 3 append.

Descriptors: *Filtration, *Activated carbon, *Laundering, *Waste water treatment, *Performance, Costs, Pilot plants, Industrial wastes, Waste water.

The treatment of industrial laundering wastewaters by ultrafiltration and activated carbon adsorption was investigated. Pilot-scale testing was done at Abcor, Inc., pilot-scale testing was done at a field demonstration site, and an economic analysis was performed of full-scale treatment systems. Noncellulosic spiral-wound ultrafiltration modules were used in all experiments. A consistently high quality product water was produced. The operation of the spiral-wound ultrafiltration modules was hindered by the fouling tendency of the feed stream. Thus, average module permeate flux was low. This resulted in high capital and operating cost estimates for full-scale treatment systems. For a 100,000 gpd treatment system (assuming 14 gfd flux and 98% water recovery), operating cost was estimated to be $9.01/1000 gal. Total carbon adsorption costs of $1.07/1000 gal could be offset by credits gained from reuse of the product water within the laundry. (Small-FRC)
W79-07786

COMPATIBILITY OF FLOCCULATING AGENTS WITH RDX/TNT/COMP B,
Picatinny Arsenal, Dover, NJ. Feltman Research Labs.
T. C. Castorina, J. W. McCahill, and A. C. Forsyth.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 136, Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum 2224 1977. 14 p, 3 fig, 3 tab, 3 ref.

Descriptors: *Flocculation, *Explosives, *Polymers, *Compatibility, *Cations, Stability, Chemical reaction, Waste water treatment, Separation techniques, Industrial wastes, Military aspects.

WT2600, WT-2635, CAT-FLOC, CAT-FLOC-T, and E-653 were evaluated as flocculating agents in the treatment of ammunition waste waters containing RDX, TNT, and Comp B. The compatibility of the polymer flocculating agents with the explosives was examined with the standard Compatibility Test. The samples consisted of 2.5 g of explosive and 2.5 g of polymer, or a 50:50 5 g mixture. The samples were placed in a glass heating vial attached to a capillary tube, and the apparatus was evacuated and sealed; the vial was heated at about 100 C for 40 hrs and the volume of gas evolved was recorded. WT-2635 is a cationic homopolymer of ethenimine, WT-2600 is a cationic copolymer of dimethyldiallyl ammonium chloride and acrylamide, CAT-FLOC is a cationic homopolymer of dimethyldiallyl ammonium chloride polyelectrolyte, CAT-FLOC-T is the same as the latter but a liquid with a higher molecular weight distribution, and E-653 is an experimental sulfonated polyacrylamide powder which is hydrolytically stable under acidic conditions at high temperatures and with acidic compounds, including explosives. The results of the tests indicated E-653 was a compatible flocculating agent. (Lisk-FRC)
W79-07787

RESULTS OF INVESTIGATIONS, T. E. MAXSON WTP AND SIGNIFICANT INDUSTRIAL CONTRIBUTORS, MEMPHIS, TENNESSEE,
For primary bibliographic entry see Field 5B.
W79-07788

FINAL REPORT ON FATE OF METALS APPLIED IN SEWAGE AT LAND WASTEWATER DISPOSAL SITES,
Texas A and M Research Foundation, College Station.
For primary bibliographic entry see Field 5B.
W79-07789

THE SURVIVAL OF HUMAN ENTERIC VIRUSES IN HOLDING PONDS,
Texas Univ. at San Antonio. Center for Applied Research and Technology.
B. P. Sagik, S. W. Funderburg, and B. E. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A034 387, Price codes: A03 in paper copy, A01 in microfiche. Report No. 76-1, 1976. 43 p, 16 fig, 10 tab, 17 ref.

Descriptors: *Viruses, *Ponds, *Sedimentation, *Human diseases, *Separation techniques, Deposition(Sediments), Waste water treatment, Municipal wastes.

Virus removal from municipal waste water in holding ponds has been studied in field models since 1975. Data from the investigation have indicated that the removal of human enteric viruses in holding ponds involves the components of inactivation and sedimentation. One factor identified in the inactivation process, especially for poliovirus inactivation, is higher temperatures. Laboratory investigations and differing field results in the winter and spring months indicate that this primary effect leads to more rapid inactivation. Increased biological activity due to increased sunlight and temperature have a secondary effect on virus survival. This biological activity has an antagonistic effect on the virus communities. Poliovirus appeared in the sediments generated by the holding ponds and further investigations revealed that poliovirus continued to be recovered from the sediments for a long period after they had disappeared from the overlying waters. These findings indicated that viral inactivation may include deposition of particulate-associated virions as a means of virus removal. (Lisk-FRC)
W79-07790

WASTEWATER CHARACTERIZATION AND PROCESS RELIABILITY FOR POTABLE WASTEWATER RECLAMATION,
Dallas Water Utilities Dept., TX.
A. C. Petrasek, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 874, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-210, 1977. 124 p, 56 fig, 22 tab, 10 ref.

Descriptors: *Water reuse, *Potable water, *Waste water treatment, *Activated sludge, *Biological treatment, Coagulation, Lime, Carbon dioxide, Gravity, Filtration, Activated carbon, Adsorption, Tertiary treatment, Water quality, Waste quality standards, Municipal wastes.

The performance of a waste water treatment facility producing an effluent product of a quality potentially suitable for potable reuse was evaluated. The reliability of individual unit processes and the effects of process instability on the product water quality were also investigated. The municipal waste water treatment sequence involved screening, degritting, primary clarification, biological treatment with completely mixed activated sludge, lime coagulation at high pH, single-stage recarbonation with liquid carbon dioxide, gravity filtration, and two-stage activated carbon adsorption. In the pilot plant, the activated sludge influent flow rate was 152 gpm while the flow rate of the product water was 18 gpm. The collection of 24-hr composite samples was performed daily for routing analyses and weekly composite samples were utilized for metals determinations. The quality of the final product water complied in all aspects with the quality criteria of the National Primary Drinking Water Regulations. Process breakdowns or instabilities, such as in the activated sludge system and the mixed-media filter, did not impair the product water quality because of the duplication of the treatment processes. (Lisk-FRC)
W79-07791

TREATMENT OF PRIMARY SEWAGE EFFLUENT BY RAPID INFILTRATION,
Corps of Engineers, Waltham, MA. New England Div.
M. B. Satterwhite, B. J. Condike, and G. L. Stewart.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 390, Price codes: A02 in paper copy, A01 in microfiche. CRREL Report 76-49, 1976. 23 p, 11 fig, 6 tab, 22 ref.

Descriptors: *Infiltration, *Return flow, *Sewage, *Recharge ponds, *Groundwater, Biochemical oxygen demand, *Chemical oxygen demand, Coliforms, Cold regions, Nutrient removal, Phosphorus, Nitrogen, Clogging, Land management, Application methods, Rates of application, Waste water treatment, Municipal wastes.

Rapid infiltration basins were evaluated as a method of treating unchlorinated primary sewage effluent in a cool and humid climate. The untreated effluent was applied to 9 treatment basins for a period of 7 days followed by a rest period of 14 days. The basin inundations resulted in effluent additions totaling about 27 m. In groundwater samples taken from the treatment site and the surrounding area, analyses indicated that total coliform bacteria, BOD, and COD had been removed. Phosphorus concentrations in the samples were about one-third those in the applied primary effluent. In comparison with previous tests, total nitrogen additions to the treatment basins during the 7 day inundation period were 54% higher in these tests. However, groundwater nitrogen levels were comparable for both tests. When longer inundation periods were attempted in an effort to decrease nitrogen concentrations, infiltration capacities of the basins demonstrated a gradual decrease. The reduced infiltration rates were attributed to surface clogging. Proper management was considered necessary for rapid infiltration basins to maintain nitrogen removal in cold climates. (Lisk-FRC)
W79-07792

FEASIBILITY STUDY OF WASTE WATER RECOVERY IN SHRIMP PROCESSING PLANTS,
Economic Development Administration Technical Assistance Project, Report 01-6-09226, 1972, 58 p, 2 fig, 79 ref, 4 append.

Descriptors: *Industrial wastes, *Food processing industry, *Waste water treatment, *Feasibility, *Recycling, Chlorination, Filtration, Settling basins, Gloucester(Mass).

The number and size of shrimp processing plants were determined which might be accommodated by the City of Gloucester water supply system, and the feasibility of possible waste water recovery systems was evaluated. Shrimp processing practices were reviewed, and water use and waste water characteristics of modern shrimp peeling machines were determined. The water quality required for shrimp processing was investigated. Possible waste water treatment and recovery systems were selected for possible further development. Water treatment would possibly include chlorination, filtration, and clarification. Abstracts are provided of literature studied. (Small-FRC)
W79-07794

A METHOD OF MANURE DISPOSAL FOR BEEF PACKING OPERATION,
Procedyne Corp., New Brunswick, NJ.
R. Ricci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 316, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-103, 1977. 63 p, 17 fig, 6 tab, 11 ref.

Descriptors: *Food processing industry, *Industrial wastes, *Filtration, *Dewatering, *Incineration, Farm wastes, Ultimate disposal, Cattle.

Preliminary studies are described for process design of a system to successfully treat paunch manure in a beef slaughtering operation. Preliminary studies were conducted to determine paunch manure characteristics, the present disposal system was evaluated, and paunch manure filtration studies were performed. A process designed in which the paunch manure is collected from the slaughtering operation and fed to a screening device which separates the coarse solids. The screenings are dewatered to a solids content of 37%, and the dewatered material is incinerated in a fluid bed incinerator. The liquid from the screening step is fed to a settler and is combined with the liquid stream from the dewaterer prior to sand filtering. The filter cake is also incinerated. The filtrate is recycled back to the settler. (Small-FRC)
W79-07795

SECURING AGRICULTURAL LAND FOR WASTEWATER IRRIGATION,
For primary bibliographic entry see Field 3C.
W79-07796

FIRST ORDER ESTIMATES OF ENERGY REQUIREMENTS FOR POLLUTION CONTROL,
Development Sciences, Inc., Sagamore, MA.
For primary bibliographic entry see Field 6B.
W79-07798

APPLICATION OF SEQUENCING BATCH REACTORS FOR TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTEWATERS (FIRST ANNUAL REPORT, JULY 1, 1976 TO JUNE 30, 1977),
Notre Dame Univ., IN. Dept. of Civil Engineering.
R. L. Irvine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 846, Price codes: A07 in paper copy, A01 in microfiche. Report NSF/RA-770259, 1977. 146 p, 8 fig, 3 tab, 31 ref, 5 append.

Descriptors: *Industrial wastes, *Municipal wastes, *Waste treatment, *Unsteady-flow, *Performance, *Biological treatment, Laboratory tests, Phosphorus, Market value, Computers.

Fill and draw reactors are evaluated in terms of their applicability to a wide variety of treatment areas, and design and control procedures are developed. An attempt is made to develop batch technology as a viable option to conventional continuous flow systems which can satisfy present and future effluent requirements. User market areas are defined. Three primary research products and user areas are actively investigated: (1) Microprocessor control system for batch or continuous flow treatment systems, (2) Single tank batch reactors for small municipalities and small industries in rural areas, and (3) Multiple tank batch reactors for larger municipalities and industries. A micro-computer control system using microprocessors is feasible for small and large treatment systems. Laboratory studies of batch treatment application to high strength wastes demonstrated that the batch system is extremely efficient from a substrate to organism conversion point of view. Also, the development of filamentous organisms and the settling characteristics of the organisms can be controlled in a batch treatment system. The relative growth rate of the filamentous organisms to the remaining organisms was strongly influenced by the waste concentration. Chemical treatment studies of the removal of phosphorus with iron salts found that the batch system developed a better flocculating sludge, was less sensitive to pH, and produced better quality effluent with reduced iron dosages when compared to continuous flow. (Small-FRC)
W79-07800

SHIPBOARD EVALUATION OF A CARLSON MARK 10 CHLORINATOR/MACERATOR SANITARY WASTE-WATER TREATMENT SYSTEM,
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
C. S. Alig.
Available from the National Technical Information

Service, Springfield, VA 22161 as AD-919 175, Price codes; A03 in paper copy, A01 in microfiche. Report 28-939, 1974. 47 p, 7 fig, 10 ref, 5 append.

Descriptors: *Waste water treatment, *Ships, *On-site tests, *Performance, *Chlorination, *Mechanical equipment, Aeration, Maintenance, Regulation, Coliforms.

The Carlson Mark 10 chlorinator/macerator sanitary wastewater treatment system was technically evaluated aboard USS Fidelity (MSO 443). Compliance with effluent quality standards set forth in MIL-S-24201B (SHIPS) was evaluated, as was the ability to obtain reliability and maintainability information. During a 1150-hour test, the system treated 16,600 gallons of wastewater. Over 28% of the samples collected exceeded military standards for effluent coliform bacteria. Eight failures were experienced which resulted in a mean time between failures of 88.5 hours at a 90% confidence interval. The maximum failure repair time was two hours and 40 minutes. Military stands were not met, and the chlorinator/macerator did not satisfy the test plan for reliability and maintainability. Effluent bacterial quality could be improved by increasing chlorination, but then high levels of chlorine would enter receiving waters. A simple preventive maintenance program could reduce system downtime. (Small-FRC)
W79-07801

THE EFFECT OF POLYACRYLAMIDE MOLECULAR STRUCTURE ON FLOCCULATION ACTIVITY OF DOMESTIC SEWAGE,
Rose-Hulman Inst. of Tech., Terre Haute, IN. Dept. of Chemical Engineering.
J. Caskey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 016, Price codes: A06 in paper copy, A01 in microfiche. Report GK-43989, 1977. 101 p, 29 fig, 16 tab, 40 ref, 8 append.

Descriptors: *Flocculation, *Polymers, *Suspended solids, *Organic matter, *Molecular structure, Hydrolysis, Hydrogen ion concentration, Sewage treatment, Cations.

The flocculating effectiveness of the branched and linear polymer fractions for suspended solids and organic matter removal was investigated. Linear and branched polyacrylamides were polymerized, the samples were fractionated into different molecular weight portions, and the resulting fractions were hydrolyzed to several anionic levels. Settling rate ratio tests with three weight percent kaolin slurries indicated increased flocculation effectiveness with increased molecular weight in a solution pH of 6.0. The effects of polymer molecular structure were studied on 220 ppm kaolin slurries and domestic sewage, and the polymer did not improve the rate of flocculation. These results confirmed the necessity of multivalent cation addition for effective flocculation of dilute slurries. A linear structure was more effective than a branched structure. Also, increasing molecular weights increased the flocculation effectiveness of the polymer for both linear and branched polymers within the molecular weight range studied. The polymer should be hydrolyzed in the range of 15-30% for optimum effectiveness. (Small-FRC)
W79-07805

CYANIDE REMOVAL FROM PETROLEUM REFINERY WASTE WATER USING POWDERED ACTIVATED CARBON,
IIT Research Inst., Chicago, IN.
J. E. Huff, and J. M. Bigger
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 862, Price codes: A06 in paper copy, A01 in microfiche. Report, 1977. 107 p, 24 fig, 25 tab, 19 ref, 1 append.

Descriptors: *Activated carbon, *Copper compounds, *Oil industry, *Oil wastes, *Adsorption, Oxidation, Continuous flow, Laboratory tests, Aqueous solutions, Activated sludge, Aerated lagoons, Waste water treatment, Industrial wastes

Batch and continuous tests were performed to evaluate the treatment of cyanide-bearing refinery waste waters with powdered activated carbon (PAC) and cupric chloride. The operating parameters of pH, copper dosage, mode of copper addition, carbon dosage, and type of carbon were varied to investigate the basic chemistry and cyanide removal efficiency of the adsorption and catalytic oxidation of cyanide. When the pH was in the neutral range, low equilibrium cyanide in the aqueous solution was achieved while a low copper level was maintained. When solutions containing 0.5 mg/liter iron cyanide were treated with 250 mg/liter PAC and 1.0-1.5 mg/liter of copper, greater than 95% removal of cyanide was achieved in batch tests. In the continuous tests, two laboratory scale activated sludge units were used and carbon and copper were added to the aeration basin. The results of this study indicated that cyanide could be effectively removed by the addition of PAC and cupric chloride to the activated sludge unit without reduction of the biological efficiency of the unit. The treatment process appeared economically attractive for refineries because no capital expenditures are necessary. (Lisk-FRC)
W79-07806

EVALUATION OF LEACHATE TREATMENT VOLUME 1: CHARACTERIZATION OF LEACHATE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. S. Chian, and F. B. DeWalle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 885, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/2-77-186a, 1977. 226 p, 47 fig, 18 tab, 34 ref.

Descriptors: *Leachate, *Landfills, *Aerobic treatment, *Anaerobic treatment, *Heavy metals, Degradation, Waste water treatment, Water pollution sources, Activated carbon, Reverse osmosis.

Leachate samples collected from landfills located in the United States were analyzed for organics and inorganics. Also, bench-scale performance data were obtained for selected leachate treatment methods. Leachate from recently constructed landfills was best treated by aerobic or anaerobic processes. Leachate from stabilized landfills was best treated by activated carbon and reverse osmosis. Membrane ultrafiltration, gel permeation chromatography, and specific organic analysis were used on leachate samples to separate different molecular fractions and to determine the main types of organics and associated functional groups. Biological degradation studies revealed the sequential removal of different classes of organics presents in leachate from a recently constructed solid waste lysimeter. In most leachate, high levels of heavy metals were present. Generally, the metal concentrations did not cause toxic effects due to the formation of hydroxides and carbonates in aerobic systems and sulfides and carbonates in anaerobic systems. (See also W79-07808) (Small-FRC)
W79-07807

EVALUATION OF LEACHATE TREATMENT VOLUME 2: BIOLOGICAL AND PHYSICAL-CHEMICAL PROCESSES,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. S. Chaian, and F. B. DeWalle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 855, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-186b, 1977. 265 p, 86 fig, 20 tab, 4 ref.

Descriptors: *Anaerobic digestion, *Filtration, *Aerated lagoons, *Activated sludge, *Leachate, *Performance, Costs, Biochemical oxygen demand, Activated carbon, Oxidation, Organic matter.

The efficiencies of anaerobic filtration, aerated lagoons, and activated sludge units in removing organic matter from solid waste leachate were investigated. A completely mixed anaerobic filter, in which the effluent is diluted with recirculated effluent, was found to effectively remove organic matter concentrations in high strength, solid waste leachate over a range of organic loadings and shock loads. Various physical-chemical treatment methods such as chemical precipitation, activated carbon adsorption, and chemical oxidation were investigated and found to be not very effective in removing organic matter. Higher adsorptive capacities were observed for biologically pretreated leachate. Biologically aerated lagoons had TOC removal efficiencies of 96.8-99%, and, had high heavy metal removal rates. The combined treatment of leachate and municipal sludge in a conventional plugflow activated sludge unit effectively treated high strength leachate. Cost esimates were obtained. The aerated lagoon was the least expensive process. The combined treatment of leachate using the activated sludge process had a high dilution factor, especially when leachate BOD levels were low and flow rates were high. (See also W79-07807) (Small-FRC)
W79-07808

APPLICATION OF OXYGEN TO TREAT WASTE FROM MILITARY FIELD INSTALLATIONS, PART I. INACTIVATION OF VIRUS IN BENCH-SCALE OXYGENATED WASTE STABILIZATION PONDS,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
A. R. Melbard, J. F. Malina, and C. W. Beere.
Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-027 092, Price codes: A06 in paper copy, A01 in microfiche. Report, 1974. 112 p, 2 fig, 20 tab, 23 ref, 1 append.

Descriptors: *Viruses, *Sewage bacteria, *Oxygenation, *Oxidation lagoons, *Suspended solids, Chemical oxygen demand, Biochemical oxygen demand, Sewage sludge, Oxygen, Waste water treatment, Municipal wastes.

The application of high purity oxygen to waste stabilization ponds can prevent the reduction of treatment efficiency during overloaded conditions. While stabilization ponds treating municipal wastes may accomodate loadings from 20-70 lbs BOD/acre/day, a loading of 50 lbs BOD/acre/day is considered the average design figure. The effects of oxygenation on the inactivation of enteric viruses and bacteria were studied in a pond incorporating a downflow bubble contact aeration system utilizing pure oxygen. Settled municipal waste water was used as the feed and oxygen transfer efficiencies greater than 95% were achieved. The yield was 0.47 lb volatile suspended solids/lb COD removed; the decay coefficient was 0.02/day. The maximum specific growth rate was 3.7 lb volatile suspended solids produced per pound volatile suspended solids; the half-velocity constant was 281 mg/liter. The system achieved 94.5% BOD removal at substrate removal rates of up to 0.73 lb BOD/lb mixed liquor suspended solids/day. Sludge separation was enhanced by auxiliary mixing and the sludge volume index was 84 ml/g. The introduction of high purity oxygen to the waste stabilization ponds increased the dieoff and inactivation of enteric viruses and bacteria. (See also W79-07810) (Lisk-FRC)
W79-07809

APPLICATION OF OXYGEN TO TREAT WASTE FROM MILITARY FIELD INSTALLATIONS PART II. AN EVALUATION OF AN ACTIVATED SLUDGE PROCESS EMPLOYING DOWNFLOW BUBBLE CONTACT AERATION,
Texas Univ. at Austin. Dept. of Environmental Health Engineering.
A. R. Melbard, J. F. Malina, and C. W. Beere.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A027 034, Price codes: A05 in paper copy, A01 in microfiche. Report 1974. 96 p, 19 fig, 8 tab, 46 ref, 1 append.

Descriptors: *Activated sludge, *Aeration, *Oxygenation, *Pilot plants, *Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Design criteria, Waste water treatment, Municipal wastes.

The performance of a downflow bubble contact aeration system in an activated sludge waste water treatment system was evaluated. Kinetic coeffi-

ient calculations indicated that the sludge yield vas 0.47 lb volatile suspended solids/lb COD removed, the endogenous respiration coefficient was 0.02/day, the maximum net specific growth rate vas 3.7 lbs volatile suspended solids produced/lb volatile suspended solids, and the substrate concentration at half the maximum net specific growth rate was 281 mg/liter. The concentration at half he maximum net specific growth rate was 281 ng/liter. The system removed 94.5% of the BOD, 30.4% of the COD and 70.0% of the suspended solids. Modifications to the system eliminated sludge flotation and significantly improved solids separation. The installation of automatic monitoring and control equipment was considered necessary to maintain longer unattended, uninterupted service. The design of the system was inflexible to severe changes in the loading; the addition of an equalization basin to overcome high peak loadings may reduce the variability of performance. A pop-off valve to reflood the chamber in the event of phase separation was recommended. Other recommendations for designing pilot plant and large scale activated sludge systems with downflow bubble contact aeration were presented. (See also W79-07809) (Lisk-FRC)
W79-07810

USA-USSR WORKING GROUP ON THE PREVENTION OF WATER POLLUTION FROM MUNICIPAL AND INDUSTRIAL SOURCES SYMPOSIUM ON PHYSICAL-MECHANICAL TREATMENT OF WASTEWATERS, HELD AT CINCINNATI, OHIO ON APRIL 5-6, 1977,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 663, Price codes: A07 in paper copy, A01 in microfiche. 1977. 144 p, 81 fig, 19 tab, 102 ref. No. 9, Environmental Protection Agency, Washington, DC.

Descriptors: *Industrial wastes, *Municipal wastes, *Waste water treatment, *Sewerage, *Filtration, Settling basins, Incineration.

Thirteen papers were presented on the physical-mechanical methods of waste water treatment. Topics included pyrolysis of municipal and industrial wastes, physical treatment of oil refinery waste water, radial settling tanks, and effluent treatment in the paper industry. Also discussed were: microstrainers, the role of zeta potential in refinery waste waters, Sala-HGMF high gradient magnetic filters, flotation, and tertiary granular filters. The treatment of mining, metallurgical, and oil-chemical wastes, the swirl concentrator, and sewerage in Moscow are also discussed. (See W79-07812 thru W79-07824) (Small-FRC)
W79-07811

PYROLYSIS APPLICATIONS FOR INDUSTRIAL AND MUNICIPAL TREATMENT,
Envirotech Corp., Menlo Park, CA.
F. P. Sebastian, D. S. Lachtman, G. K. Kroneberger, and T. D. Allen.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 5-14, 1977. 5 fig, 3 tab, 6 ref.

Descriptors: *Ultimate disposal, *Incineration, *Sludge disposal, *Evaluation, Industrial wastes, Municipal wastes, Economics, Regulations, Energy, Water quality.

Pyrolysis in a multiple hearth furnace was investigated and found to have a number of advantages over conventional incineration. This process improves process control and prevents clinker formation. Also, it offers economical energy recovery. Other advantages include increased furnace capacity, potential revenue from stream or power, reduced particulate loading prior to scrubbing, and a permanent solution to solids disposal. The method has numerous industrial applications. Pyrolysis in a multiple hearth furnace meets Environmental Protection Agency emission regulations, and has been proven on a full scale. Bacterial, viral, and organic contamination of groundwater is avoided when thermal destruction methods are used. (See also W79-07811) (Small-FRC)
W79-07812

WASTE WATER TREATMENT BY PHYSICAL AND MECHANICAL METHODS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
I. N. Mjasnikov, V. G. Ponomarjev, A. P. Nechaev, and I. V. Kedrov.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 15-22, 1977. 10 fig.

Descriptors: *Sedimentation, *Centrifugation, *Filtration, *Flotation, Waste water treatment, *Performance, Municipal wastes, Industrial wastes, Mechanical equipment.

Waste water treatment by physical and mechanical methods is reviewed, and the results of investigations carried out by VODGEO are mentioned. Sedimentation is discussed. Hydraulic investigations of thin-layer settling tanks that operate according to cross scheme have indicated that maximum efficiency of volume utilization up to 80-90% is achieved when using proportional water distribution devices designed by VODGEO. Pressure hydrocyclones are described, and a hydrocyclone with an internal cylinder and tapered membrane located in the upper part and a multistage hydrocyclone are discussed. Other centrifuges considered include bowl centrifuges, pendulum centrifuges, and scroll centrifuges. VODGEO investigated low-speed centrifuges with a separation factor up to F = 800. Flotation treatment methods are described, and filtration of waste water is discussed. VODGEO has found that the use of a filter charged with polyurethane removed 90% of oil from waste water at a filtering rate of up to 20 m/hr. (See also W79-07811) (Small-FRC)
W79-07813

PHYSICAL TREATMENT OF OIL REFINERY WASTEWATER,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
W. J. Lacy.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 23-26, 1977.

Descriptors: *Activated carbon, *Industrial wastes, *Oil industry, *Adsorption, *Performance, Costs, Chemical oxygen demand, Separation techniques, Oxidation.

Physical treatment is defined, and the results of a demonstration project on activated carbon treatment of refinery effluent are presented. Gravity separation, solvent extraction, adsorption, combustion, and filtration are described. The demonstration treatment system was made up of four main systems plus an impounding reservoir. The water treatment unit reduces the organic COD of water impounded in the refinery prior to discharge. It consists of 12 identical adsorber cells, each cell containing a 4 m deep bed of carbon having a dry weight of approximately 22,100 kg supported by gravel. The carbon regeneration system utilizes selective oxidation of the organic impurities in the pores at high temperatures (900-970C) and with a controlled low oxygen atmosphere in a multiple hearth furnace. During the two-year project, 172,040,000 gallons of water was processed to load 747,000 kg of carbon with 165,000 kg or COD. The overall operating cost was 49 cents per 1000 gallons of water treated, or 524 kg of COD removal from the water. During the second year, the plant demonstrated the ability to operate at 40 cents per 1000 gallons of water treated. (See also W79-07811) (Small-FRC)
W79-07814

IMPROVEMENT OF HYDRAULIC CONDITIONS OF RADIAL SETTLING TANKS,
Vsesoyuznyi Nauchno-Issledovatelskii, Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
I. V. Skirdov.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 26-30, 1977. 3 fig.

Descriptors: *Sedimentation, *Settling basins, *Hydraulic machinery, *Performance, Design, Waste water treatment.

The advantages of radial settling tanks over other types of settling tanks are discussed, and a new type of radial tank developed in the USSR is described. Radial settling tanks are often utilized at large treatment facilities. The hydraulic conditions of conventional radial settling tanks do not ensure the effective use of most of these installations. The newly developed tank has a water distributing device which rotates continuously with the scraping arm. Hydraulic conditions are improved, installation load can be increased about 1.5 times, and the depth of the tank can be significantly reduced, when the rotatory distributing device is employed. (See also W79-07811) (Small-FRC)
W79-07815

CURRENT STATUS AND DIRECTIONS OF DEVELOPMENT OF PHYSICO-MECHANICAL EFFLUENT TREATMENT IN THE PAPER INDUSTRY,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
I. Gellman.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 31-39. 1977, 32 ref.

Descriptors: *Pulp and paper industry, *Industrial wastes, *Sedimentation, *Filtration, *Dewatering, Recycling, Activated sludge, Waste water treatment, Sludge treatment, Aeration, Settling basins, Flotation, Biological treatment.

Physico-chemical treatment of effluent in the paper industry is reviewed including: clarification of untreated or biotreated mill effluents by gravity separation or filtration, in-process use of treatment for improved water economy and reduction of organic load, and dewatering and disposal of sludge. Methods for the clarification of biotreated effluents are: Quiescent zone sedimentation in aerated stabilization basin systems, secondary sedimentation for activated sludge treatment systems, secondary flotation for aerated stabilization basin effluent clarification, and media filtration of biologically treated effluents. White water system reuse studies have included combination waste paperboard operations, fine paper manufacture, and tissue and towelling manufacture. Condensate stripping methods include kraft condensate processing and sulfite condensate processing. Current sludge dewatering practices are reviewed. In the future it is likely that total mill effluent clarification at the primary level will be characterized by physico-mechanical methods. At the secondary clarification level, more frequent use of coagulant aids is anticipated to meet water quality standards. Greater internal water reuse is expected, and stripping of condensates from chemical pulp mill liquor evaporation and heat recovery systems will become more extensive. (See also W79-07811) (Small-FRC)
W79-07816

EMPLOYMENT OF MICROSTRAINERS IN THE WASTE WATER TREATMENT PRACTICE,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
I. V. Skirdov, I. A. Sidorova, and Yu. L. Maximenko.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial

Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 39-44, 1977. 4 fig.

Descriptors: *Filtration, *Performance, *Biochemical oxygen demand, *Suspended solids, *Industrial wastes, Waste water treatment, Effluent streams, Settling basins, Municipal wastes, Pulp and paper industry, Biological treatment.

In waste water treatment, microstrainers can be used as possible substitutes for primary clarifiers. Microstrainers are compact and economical, simple to operate, and permit the process to be automated. Microstraining provides BOD removal up to 25-30% and suspended solids removal by 45% (after pretreatment) and suspended solids removal by 50-60% and 30-40% removal of BOD (for final treatment). Microstraining is widely used for final treatment of biologically treated effluents of artificial fiber plants, pulp and paper complexes, chemical plants, and municipal sewage treatment plants. Pretreatment of waste waters with microstrainers is economically feasible. Capital expenditures can be reduced by 70 to 90% when microstrainers are used instead of primary clarifiers. When microstrainers are used for final treatment of biologically treated effluents, the area of the pond is reduced by one half. (See also W79-07811) (Small-FRC)
W79-07817

THE CONTROL OF REFINERY MECHANICAL WASTE WATER TREATMENT PROCESSES BY CONTROLLING THE ZETA POTENTIAL,
Amoco Oil Co., Chicago, IL.
J. F. Grutsch.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio. p 44-74, 1977. 26 fig, 6 tab, 13 ref.

Descriptors: *Oil industry, *Industrial wastes, *Filtration, *Optimization, *Zeta potential, Costs, Waste water treatment, Colloids, Flocculation, Flotation, Separation techniques.

Zeta potential titration curves are used to optimize waste water treatment. Zeta curves are used to quantify proper destabilization chemical treatment, compare chemical's effectiveness, and measure synergisms and antagonisms of various components in a waste stream. Thus, zeta potential curves can be used to determine the most cost effective of alternative treatment methods. Granular media filtration and dissolved air filtration, important in refinery waste water treatment, are described. Examples are presented which show the utilization of these methods to result in major capital and energy savings. For coke fines and biocolloids, pretreatment for the dissolved air filtration unit includes a flash mix (1-2 minutes) and flocculation zones (10-15 minutes) using two chemicals (cationic for destabilization and anionic for flocculation). A flotation zone loading of 1.5 gpm/sq ft and 30% recycle at 50 psi air pressurization are recommended for optimal phase separation. (See also W79-07811) (Small-FRC)
W79-07818

COMBINED STORM OVERFLOW TREATMENT WITH SALA-HGMF HIGH GRADIENT MAGNETIC FILTERS,
Sala Magnetics, Inc., Cambridge, MA.
D. M. Allen, and J. A. Oberteuffer.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 75-91. 1977 5 fig, 6 tab, 16 ref.

Descriptors: *Filtration, *Pilot plants, *Performance, *Costs, *Design, Biochemical oxygen demand, Bacteria, Viruses, Turbidity, Phosphates, Heavy metals, Color.

Magnetic-seeded high gradient magnetic filtration is described which permits highly effective removal of BOD, COD, bacteria, color, turbidity, and viruses from contaminated waters. The theory and design of these filters is presented and applications to two types of polluted waters are described. A 4 liter/min continuous pilot plant is being used to investigate the applicability of the indirect filtration process for treating combined sewer overflow, storm water, secondary effluent, and dry weather sewage flow. The pilot plant contains a flocculation train in which all necessary chemical additions are made, a SALA-HGMF magnetic filter and power supply, and a surge tank and thickener to handle the backflushed flocs. Performance of the high gradient magnetic filters exceeds conventional treatment and significantly reduces the levels of phosphates, heavy metals, and viruses in waste waters. Capital cost for a high gradient magnetic filtration integrated wet and dry weather flow facility is $107,000/mgd as compared to $168,000/mgd for a comparable physical-chemical treatment facility, and $73,000/mgd for a dual media filtration plant using polyelectrolyte. (See also W79-07811) (Small-FRC)
W79-07819

USE OF FLOATATION FOR WASTE WATER TREATMENT,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
I. N. Mjasnikov, L. V. Gandurina, and L. N. Butseva.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 91-99, 1977. 4 fig, 5 ref.

Descriptors: *Flotation, *Industrial wastes, *Oil industry, *Frothing, *Performance, Biochemical oxygen demand, Separation techniques, Oily water, Bubbles.

Flotation is used as a treatment method for waters contaminated with oil wastes, oil processing products, fats, resins, latexes, organic synthesis products, surface-active agents, and dyestuffs. The types of flotation used include compression, impeller, vacuum, biological chemical, electric, ionic, and froth separation. Compression is usually employed to treat oil containing waste water, and frother cells have been designed with up to 80-98% efficiency. Considerable reductions in COD and BOD have been achieved. For waste water treatment, system modifications include straight-flow, recirculation, and partially straight flow. Frother separation is used along with compression for final treatment of biologically purified waste water. A recent development, electroflotation, utilizes uniformly distributed, microbubbles of gas. Treatment of oil containing waste water with electroflotation can reduce the oil content up to 1-10 mg/liter when original concentration is 200 mg/liter. (See also W79-07811) (Small-FRC)
W79-07820

PERFORMANCE TESTS ON FULL-SCALE TERTIARY GRANULAR MEDIA FILTERS,
Northwestern Univ., Evanston, IL. Dept. of Civil Engineering.
J. A. FitzPatrick, and C. L. Swanson.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio. p 100-114, 1977. 9 fig, 4 tab, 6 ref.

Descriptors: *Filtration, *Performance, *Design, *Flow rates, *Suspended solids, Correlation analysis, Tertiary treatment.

Eight small-scale (0.8-2.5 mgd) tertiary granular media filtration plants in Chicago were evaluated. Filtration plant performance was characterized as a function of design and operational variables. For plants with varied flow to individual filters, average clarification performance decreased linearly with average flow rate. Relatively poor correlations were obtained between filter solids removal efficiency and operating parameters due to seasonal and other variations. Improved correlations were obtained for data analyzed over shorter time periods. Run length did not affect plant performance except in one case where backwash frequency was varied over a wide range. Variations in clarification efficiency from plant to plant were due to differences in characteristics of secondary effluent suspended solids rather than media grain size and depth. (See also W79-07811) (Small-FRC)
W79-07821

SEWAGE TREATMENT IN MINING, METALLURGICAL AND OIL-CHEMICAL INDUSTRIES,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi 'USSR).
N. V. Pisanko.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio. p 115-121, 1977. 5 fig.

Descriptors: *Industrial wastes, *Mineral industry, *Dewatering, *Chemical industry, *Flocculation, Filtration, Waste water treatment, Separation techniques.

Technologies developed by the Ukrvodokanalproekt Institute are described and discussed. A method was developed to recycle the water used in the extraction of iron from ore by clarification of the rock-pulp and pulp thickening. The basic design of the thickener is described. A vortex dispenser for the preparation of polyacrylamide solution is also described. The system saves up to 10% of the polyacrylamide and improves the process of pulp clarification and thickening. A project to remove cinder from rolling mill waste using magnetic flocculation is described. A project utilizing quartz filters for oil industry waste treatment is also described. Maximum pollution reduction and decreased water consumption are goals of all Ukrvodokanalproekt projects. (See also W79-07811) (Small-FRC)
W79-07822

THE SWIRL CONCENTRATOR FOR TREATING AND REGULATING SEWERED (SEPARATE AND COMBINED) AND UNSEWERED FLOWS,
Municipal Environmental Research Lab., Cincinnati, OH.
R. Field.
In: USA-USSR Working Group on the Prevention of Water Pollution from Municipal and Industrial Sources Symposium on Physical-Mechanical Treatment of Wastewaters, April 5-6, 1977, Cincinnati, Ohio, p 122-133, 1977. 9 fig, 24 ref.

Descriptors: *Separation techniques, *Suspended solids, *Sedimentation, *Municipal wastes, Pilot plants, Erosion control, Urban runoff.

A swirl concentrator was developed and demonstrated for treating and regulating sewered and unsewered waste water flows. Swirl concentrators are static, non-mechanical devices which remove suspended solids by rotationally induced forces causing inertial separation and vertical gravity sedimentation with relatively short detention times. Swirl design characteristics are described, and a modeling study is discussed. Operation is described for a Syracuse, New York prototype swirl regulator/concentrator, a Denver, Colorado pilot swirl degritter, a Rochester, New York pilot swirl primary separator and swirl degritter, and a Lancaster, Pennsylvania prototype regulator/concentrator can also be used as an erosion control device or an urban runoff pollution control device. The swirl principal can be employed anywhere it is desirable to remove solids from liquid flows. Better efficiencies are achieved with steady flow conditions or when two half-size chambers are used rather than one full-size unit. (See also W79-07811) (Small-FRC)
W79-07823

SEWAGE TREATMENT OF THE CITY OF MOSCOW,

Vater Supply and Sewerage Administration, Ioscow (USSR).
. I. Galanin.
n: USA-USSR Working Group on the Prevention f Water Pollution from Municipal and Industrial ources Symposium on Physical - Mechanical reatment of Wastewaters, April 5-6, 1977, Cincinati, Ohio, p 133-138, 1977. 3 fig.

escriptors: *Activated sludge, *Municipal astes, *Sewerage, *Tertiary treatment, Industrial astes, Biological treatment, Water pollution ources.

Ioscow's sewerage and treatment systems are described. The central sewerage system serves 98.5% f the city's population with treatment plants with total capacity of 4,230,000 cu m/day. 4.3 million u m/day is subjected to biological treatment. bout 40% of this total is industrial wastes. Activated sludge plants are used and the discharging of aw sewage into waterways has almost been eliminated. The activated sludge plants utilize the following scheme: screens, grit chambers, primary ettling tanks, aeration tanks, secondary settling nks. Tertiary treatment is becoming more ommon. At the activated sludge plants treatment onsists of digestion in aerobic digesters at thermohilic conditions (52 C), washing and thickening, oagulation vacuum filtration, and heat drying. uture plans are discussed. (See also W79-07811) Small-FRC)
V79-07824

IANDLING, TREATMENT AND DISPOSAL OF WASTEWATER SLUDGE.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-258 169, rice codes: A08 in paper copy, A01 in microfiche. apers presented at USA/USSR Symposium held Iay 13-16, 1975, Moscow. 1975. 147 p.

escriptors: *Sludge disposal, *Ultimate disposal, Industrial wastes, *Municipal wastes, Incineraion, Dewatering, Agricultural engineering, Filtraion, Oily water, Waste water treatment.

ixteen papers were presented on the handling, reatment, and disposal of waste water sludge. opics included sludge incineration, oil sludge reatment, municipal sludge treatment, industrial vaste water sludges, sludge thickening and dewaering by vibro filtration, thermal drying of dewaered sludge, dissolved air flotation thickening, and tilization of sludge in agriculture. (See W79-07826 hru W79-07841) (Small-FRC)
V79-07825

POLICY ON MUNICIPAL SLUDGES,
Environmental Protection Agency, Washington, DC. Municipal Construction Div.
For primary bibliographic entry see Field 5F.
W79-07826

SLUDGE INCINERATION SYSTEMS FOR PURIFICATION AND RESOURCE RECOVERY,
Envirotech Corp., Menlo Park, CA.
For primary bibliographic entry see Field 5E.
W79-07827

INDUSTRIAL SLUDGE DISPOSL PRACTICES,
Environmental Protection Agency, Washington, DC. Industrial Pollution Control Div.
For primary bibliographic entry see Field 5E.
W79-07831

THICKENING AND DEWATERING OF WASTE WATER SLUDGES BY VIBRO FILTRATION METHOD,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
For primary bibliographic entry see Field 5E.
W79-07832

MUNICIPAL SLUDGE MANAGEMENT RESEARCH PROGRAM IN THE U.S.A.,
National Environmental Research Center, Cincinnati, OH. Advanced Waste Treatment Research Lab.
For primary bibliographic entry see Field 5E.
W79-07833

DEWATERING OF SEWAGE SLUDGE BY MEANS OF CENTRIFUGES,
For primary bibliographic entry see Field 5E.
W79-07835

THERMAL DRYING OF DEWATERED SEWAGE SLUDGE,
For primary bibliographic entry see Field 5E.
W79-07836

THICKENING OF SLUDGES,
Delaware Univ., Newark.
R. I. Dick.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 93-100, 1975. 5 fig, 13 ref.

Descriptors: *Sludge treatment, *Dewatering, *Costs, *Design, *Optimization, Sludge disposal, Sedimentation rates, Equations.

Basic sludge thickening concepts are reviewed, and the optimum design for sludge thickeners is examined. The rational basis for design of thickeners is reviewed briefly, and the interaction of thickening with other sludge treatment and disposal processes is examined quantitatively. Thickening greatly influences the cost of sludge treatment and disposal because the cost effectiveness of sludge treatment and disposal techniques depends on the concentration of solids in the sludge. The effect of the design of thickeners on the cost of sludge treatment are discussed. Thickeners should be sized with regard to the thickening properties of the sludge being treated and the settling characteristics of the sludge. An equation is presented for the calculation of required thickener size. (See also W79-07825) (Small-FRC)
W79-07838

DISSOLVED AIR FLOTATION THICKENING AS PRACTICED IN THE U. S.,
Envirex, Inc., Waukesha, WI.
W. N. Konrad.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 101-108, 1975. 7 fig.

Descriptors: *Sludge treatment, *Flotation, *Pilot plants, *Optimization, Design, Flow rates, Suspended solids, Pressure.

Dissolved air flotation thickening secondary of biological sludges has demonstrated its ability to reduce the hydraulic loading on subsequent units. In the United States applications include preceding anaerobic digestion, vacuum filtration, or centrifugation. Design parameters which must be considered in this process are spacing and speed of flights which remove the surface thickening sludge, frequency of removal, tank configuration, source of pressurized flow, and air to solids ratio. High rate loadings and various air to solids ratios were evaluated on a full scale dissolved air thickener. An attempt was made to determine what happens when the air to solids ratio is changed by changing the pressure and then by keeping the same pressure and changing the air to solids ratio by changing the volume of recycle flow which contains the dissolved air. A change in the air to solids ratio by increasing the pressure was detrimental to the operation of the unit, and 40 psig was the optimum operating pressure. The air to solids ratio can be converted directly to a practical design approach by using 100% recycle or pressurized flow for every 1/2% of influent sludge concentration while operating at 40 psig. An air to solids ratio of about 0.015 results. (See also W79-07825) (Small-FRC)
W79-07839

THE DEPENDENCE OF DEWATERING PROCESS ON AQUEOUS PROPERTIES OF SLUDGES,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidro-geologii, Gosstroy (USSR).
For primary bibliographic entry see Field 1A.
W79-07841

PROCEEDINGS OF THE SEMINAR ON CURRENT APPROACHES IN WASTEWATER TREATMENT.
Held April 5, 1978 at the Ontario Ministry of Health Laboratories, Toronto, Canada. (1978) 140 p, 25 fig, 22 tab, 82 ref. Pollution Control Association of Ontario and the Ontario Ministry of the Environment.

Descriptors: *Sewage treatment, Water treatment, *Grants, *Tertiary treatment, *Dewatering, *Oxidation, Vacuum drying, Nitrification, Activated sludge, Biological treatment, Disinfection, Waste water treatment, Municipal wastes.

Six papers were presented on current processes and methods of evaluating waste water treatment alternatives. Topics discussed included Ontario's grant policy for low-cost alternatives to communal water and sewage treatment, tertiary treatment experience in a region of Canada, operating experience with the Zimpro low-pressure, wet air oxidation unit, treatability studies for initiating nitrification in activated sludge systems, fixed film biological process utilization, and methods of evaluating disinfection alternatives. (See W79-07843 thru W79-07848) (Lisk-FRC)
W79-07842

NEW ONTARIO POLICY FOR LOW COST ALTERNATIVES TO COMMUNAL WATER AND SEWAGE TREATMENT,
Ontario Ministry of the Environment (Toronto).
For primary bibliographic entry see Field 6E.
W79-07843

YORK REGION'S OPERATIONAL EXPERIENCE WITH TERTIARY TREATMENT,
J. W. G. Rupke, J. D. Seldon, and A. T. Robson.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 7-36, 1978. 10 tab.

Descriptors: *Tertiary treatment, *Filters, *Canada, *Settling basins, *Treatment facilities, Dewatering, Cost comparisons, Sands, Coals, Biochemical oxygen demand, Suspended solids, Phosphorus, Waste water treatment, Municipal wastes.

More than half of the 11 municipal waste water treatment plants in the Regional Municipality of York in Canada utilize tertiary treatment. The flows at the treatment plants range from .44-2.40 imperial mgd and utilize gravity or pressure filters; one plant provides tertiary clarification. Filter areas range from 255-20,000 sq ft and utilize single layers or mixtures of anthracite, sand, and/or gravel. Effluent from the plants meet discharge guidelines for BOD, suspended solids, and total phosphorus. While the tertiary clarification system has been relatively trouble free, the operation requires more labor and costs and must be monitored and controlled on a daily basis. The filters must be enclosed in a building whereas the clarifiers may be exposed and may also be used as chlorine contact basins. Tertiary clarifiers may require chemical sludge thickening tanks. (See also W79-07842) (Lisk-FRC)
W79-07844

ROLE OF TREATABILITY STUDIES FOR THE DESIGN AND OPERATION OF NITRIFICATION IN ACTIVATED SLUDGE PLANTS,
Ontario Ministry of the Environment, Toronto.
A. G. Smith.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 47-71, (1978). 5 fig, 2 tab, 23 ref.

Descriptors: *Nitrification, *Activated sludge, *Optimization, *Aeration, *Alkalinity, Toxicity,

Nitrates, Nitrites, Waste water treatment, Municipal wastes.

Control parameters necessary for promoting nitrification in activated sludge systems are reviewed as an alternative to the expansion of the aeration basins. Conditions in the reactor must be maintained suitable for the growth of nitrosomas and nitrobacters which convert ammonia to nitrite and nitrate. The activated sludge system may be a single sludge system in which both carbonaceous and nitrogenous oxidation occur simultaneously or a two sludge system where the processes are separated. When the ratios of BOD/total Kjeldahl nitrogen and COD/NH4-N (C/N) are reduced, increased nitrification per reactor volume may be achieved. Because a high C/N ratio waste water will stimulate heterobacter bacteria growth, this ratio should be reduced to 2:1 to promote nitrifier growth. The optimum pH for the nitrifiers is between 7.2-8.3; nitrification rates increase with increasing pH and may reduce aeration requirements. Effluent alkalinity should be maintained at 50 mg/liter as CaCO3 for effective nitrification. The nitrification rate improves when dissolved oxygen content is raised from 1 to 2 mg/liter. Chromium, nickel, copper, phenols and other organic materials can be toxic to the nitrifiers at certain concentrations. Lower waste water temperatures will require higher solids retention times. Treatability evaluations, plant influent analysis, historical plant data, and full-scale evaluation are recommended when implementing nitrification in activated sludge. (See also W79-07842) (Lisk-FRC)
W79-07846

NEW DEVELOPMENTS UTILIZING FIXED FILM BIOLOGICAL PROCESSES,
Dorr-Oliver Inc., Stamford, CT.
P. M. Sutton.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 73-115. (1978) 17 fig, 4 tab, 42 ref.

Descriptors: *Trickling filters, *Biological treatment, *Porous media, *Packed beds, *Nitrification, Aerobic treatment, Anaerobic digestion, Denitrification, Industrial wastes, Waste water treatment, Municipal wastes.

The use and performance of fixed film biological reactors are discussed for the treatment of municipal and industrial waste waters and for nitrification. Trickling filters, supporting a biological slime on rocks, wooden slats, plastic sheets, or other support media, are utilized for treating municipal effluent, industrial wastes, and ammonia concentrations and have led to the development of other packed bed reactors for both aerobic and anaerobic treatment. The types of reactors include fixed bed upflow reactors containing porous media of various sizes exhibiting minor pressure gradients; expanded bed upflow reactors demonstrating a constant pressure gradient; and fixed bed downflow or upflow reactors with increasing pressure gradients which require backwashing or flushing. Rotating biological contractors have eliminated problems common to trickling filters and other fixed beds and have been utilized in the treatment of industrial waste waters and the denitrification of municipal waste waters. The principles, design fundamentals, and design considerations are described for fixed film reactors, expanded or fluidized bed reactors, and rotating biological contactors. Applications and performance efficiencies of fixed film and suspended growth systems were compared. (See also W79-07842) (Lisk-FRC)
W79-07847

EVALUATING DISINFECTION ALTERNATIVES,
F. A. Tonelli, and A. K. W. Ho.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 117-138. (1978) 2 fig, 4 tab, 17 ref.

Descriptors: *Disinfection, *Comparative benefits, *Chlorine, *Ozone, *Ultraviolet radiation, Bromine, Toxicity, Cost comparisons, Coliforms, Viruses, Chemical properties, Waste water treatment, Waste water disposal, Municipal wastes.

Chlorine and disinfectant alternatives were evaluated for effectiveness, use-cost, practicality, and potential adverse effects. The disinfectants investigated include chlorine, chlorine dioxide, ozone, bromine chloride, and ultraviolet radiation. Effectiveness was evaluated as the disinfectant's ability to reduce total and fecal coliforms, to inactivate viruses, and to eliminate other pathogenic bacteria. Use-costs were considered as capital costs, amortization costs, operating and maintenance costs, and costs of special waste water pretreatment. Practicality evaluations considered factors of transport, storage, on-site generation, application, control, disinfection predictions, and safety. Desirable properties of chemical disinfectants were considered to be: chemical weakness, predictable chemistry in waste water, readible solubility, and nontoxic or fast-decaying residual; desirable radiation properties include chemical weakness and adequate penetrating power. Potential adverse effects of the disinfected waste water on the receiving waters are considered as toxicity to aquatic life, the formation and transmission of undesirable bio-accumulating substances, and the formation and transmission of toxic, mutagenic, or carcinogenic substances. Results of the evaluation indicated that no single, widely applicable alternative to chlorine disinfection had been demonstrated. Ozone was considered the best developed alternative, but its cost is high and it has limited applicability. Dechlorination was considered feasible for reducing the toxic effects of chlorine. (See also W79-07842) (Lisk-FRC)
W79-07848

PROCEEDINGS OF THE 23RD ONTARIO INDUSTRIAL WASTE CONFERENCE.
Held June 13-16, 1976 at Toronto, Ontario. (1976) 483 p. Ministry of the Environment, Ontario.

Descriptors: *Industrial wastes, *Sewage disposal, *Waste water treatment, *Separation techniques, Oil industry, Heavy metals, Pesticide residues.

The proceedings of the 23rd Ontario Industrial Waste Conference contains 19 papers on the disposal and treatment of industrial wastes. Topics include the control of hydrogen sulfide emissions at a heavy water plant, control of heavy metal levels discharged into municipal sewers, and solid/liquid separation techniques. A refinery waste water treatment system, pollution abatement at a starch plant, waste water treatment at a General Motors plant, and control of PCBs are discussed. The role of the Ministry of the Environment in the disposal of liquid industrial waste is summarized. (See W79-07850 thru W79-07857) (Small-FRC)
W79-07849

DISCHARGE OF HEAVY METALS TO MUNICIPAL SEWERS 'THE CRUNCH MAY COME',
Ontario Ministry of the Environment, Toronto. Wastewater Treatment Section.
S. A. Black.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976, Toronto, Ontario, p 155-178. (1976) 7 tab, 25 ref.

Descriptors: *Heavy metals, *Industrial wastes, *Municipal wastes, *Ultimate disposal, Regulation, Sewage treatment, Toxicity, Sludge disposal.

Increasingly high heavy metals content in municipal sewage may cause problems in sewage treatment and ultimate disposal of sewage sludge. Heavy metals are in industrial wastes which are often discharged into city sewers and in domestic wastes. Heavy metals reduce the efficiency of aerobic sewage treatment and anaerobic digestion of sewage sludges. Also, high levels of heavy metals can prevent sludge disposal on agricultural lands. One control method is the precipitation and recovery of metals from the sewage or sludge. Fluidized bed electrodes and digestion with sulfuric acid are two methods of removal from sewage. Industries can be regulated to reduce heavy metals discharge. Examples of this approach in the cities of Windsor and Waterloo are described. (See also W79-07849) (Small-FRC)
W79-07850

THE CONTROL OF HYDROGEN SULPHIDE EMISSIONS AT ONTARIO HYDRO'S BRUCE HEAVY WATER PLANT,
Bruce Heavy Water Plant Ontario Hydro, Tiverton.
S. A. C. Franklin.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976, Toronto, Ontario, p 70-103, (1976), 23 fig.

Descriptors: *Hydrogen sulfide, *Separation techniques, *Monitoring, *Industrial wastes, Waste water treatment, Water pollution sources, Lake Huron.

Air and water hydrogen sulfide emissions are controlled at Ontario Hydro's Bruce Heavy Water Plant A which uses hydrogen sulfide to extract deuterium from natural water. All water streams containing H2S are stripped before returning the water to Lake Huron. The strippers discharge their effluent into a common line which can be diverted to lagoons. The effluent stripper process parameters including feed temperature, level, and pressure were interlocked to automatically divert the effluent to lagoons if the measured variables exceeded defined limits. Also, an H2S monitor was installed which prevents any sour water from entering the lake. Operator training was found to be an essential part of pollution control. (See also W79-07849) (Small-FRC)
W79-07851

SOLID LIQUID SEPARATION UTILIZING AN INCLINED PLATE SEPARATOR AND FILTER PRESS,
Control and Metering Ltd., Toronto (Ontario).
R. Verstraete.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976, Toronto, Ontario, p 179-201. (1976) 8 fig, 1 tab, 10 ref.

Descriptors: *Separation techniques, *Filters, *Costs, *Performance, *Sludge treatment, Dewatering, Sedimentation, Industrial wastes.

The principle of operation of the inclined plate clarifier is reviewed, and operating experience in Ontario is discussed for the inclined plate separator and filter press. The inclined plate clarifier is efficient, easy to operate, requires reduced floor space, has no moving parts, and has low capital costs. It requires as little as 10% of the floor space of conventional clarifiers and installed costs are less than 50% of conventional clarifiers. The recessed plate filter press is a sludge dewatering device. The solids from the sludge are retained within the filter media to form a low volume dry cake of 30-60% solids while producing a clear filtrate. Filter presses have high efficiency, low energy consumption, and low manpower requirements. (See also W79-07849) (Small-FRC)
W79-07852

DEVELOPMENT AND IMPLEMENTATION OF AN IMPROVED WASTE WATER TREATMENT SYSTEM AT IMPERIAL'S SARINA REFINERY,
Imperial Oil Enterprises, Ltd., Sarnia (Ontario).
G. W. Schindel.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976. Toronto, Ontario, p 202-230. (1976) 7 fig, 4 tab.

Descriptors: *Oil industry, *Waste water treatment, *Filtration, *Design, *Pilot plants, Regulation, Sewerage, Suspended solids, Industrial wastes.

A program to upgrade the waste water treatment capability at Imperial Oil Enterprises, Ltd.'s Sarnia Refinery initiated in 1970 is described. It included a comprehensive program to segregate sewer systems with a view toward minimizing the volume of contaminated water requiring further treatment. Also, a dual media gravity flow filtration system was installed for secondary removal of oil and suspended solids. An activated sludge plant was

installed to remove a substantial portion of the dissolved organics from the refinery effluent. Developmental and pilot studies are discussed along with the design details of the system. Operating experience is reported and compared to predicted performance. The treatment system has provided the refinery with a system entailing the best practicable technology and which has the capability to meet all Provincial and Federal guidelines. (See also W79-07849) (Small-FRC)
W79-07853

POLLUTION ABATEMENT AT CANADA STARCH - A CASE STUDY,
Canada Starch Co. Ltd., Cardinal (Ontario).
G. N. Fulford.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976, Toronto, Ontario, p 231-264. (1976) 8 fig, 4 tab, 16 ref.

Descriptors: *Industrial wastes, *Biochemical oxygen demand, *Monitoring, *Aerobic treatment, Aeration, Waste water treatment, Water pollution sources.

The pollution problems associated with the operation of a corn wet milling plant and their solution at one site are discussed. The effluent streams were divided into those acceptable for discharge into the St. Lawrence River and into a single stream with BOD readings of up to 3000 ppm. Technicon Monitor IV's were used to monitor the acceptable streams. A single cell aerobic facultative or aerated lagoon was used to treat the high BOD waste. The lagoon was constructed by converting an old submerged canal in the St. Lawrence Seaway into a waste treatment plant with approximately 30 days retention time. The plant has operated with an 85-90% reduction of BOD during the summer months and 60-75% reduction during the colder months. The total program is responsible for an overall reduction of 85-90% in BOD to the St. Lawrence River. (See also W79-07849) (Small-FRC)
W79-07854

WASTEWATER TREATMENT AND OIL RECLAMATION AT GENERAL MOTORS, ST. CATHERINES,
General Motors of Canada Ltd., St. Catherines (Ontario).
R. E. Johnson, Jr.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, held June 13-16, 1976, Toronto, Ontario, p 345-357. (1976) 2 fig, 2 tab.

Descriptors: *Oily water, *Reclamation, *Recycling, *Waste water treatment, Separation techniques, Regulation, Costs, Industrial wastes.

The operation of the Liquid Waste Treatment Plant located at the Axle Plant in St. Catherines, Ontario, is described. The plant treats over 270,000 gallons of liquid waste per day which consist of various oils, greases, washing chemicals, and process waters. The treatment plant separates petroleum products from the water phase via the acid-alum process. It removes pollutants from the water in compliance with Regional and Provincial laws. Also, it removes contaminants present in the separated oils and reclaims or recycles the oil back to the manufacturing plants. The chemically treated water is discharged to city sewers. Over 225,000 gallons of soluble oil concentrate and 100,000 gallons of cutting oil are produced annually at this plant at economical prices. Current experiments are described on the feasibility of formulating hydraulic oil from GM reclaimed oil. (See also W79-07849) (Small-FRC)
W79-07855

THE ROLE OF THE MINISTRY OF THE ENVIRONMENT IN THE DISPOSAL OF LIQUID INDUSTRIAL WASTE IN ONTARIO,
Ontario Ministry of the Environment, Toronto (Ontario). Pollution Control Branch.
E. W. Turner, and W. J. Hogg.
In: Proceedings of the 23rd Ontario Industrial Waste Conference, June 13-16, 1976, Toronto, Ontario, p 409-448. (1976) 6 tab.

Descriptors: *Waste disposal, *Industrial wastes, *Regulation, *Liquid wastes, Canada, Reclamation, Incineration, Landfills, Waste disposal wells, Ultimate disposal.

Actions by the Ministry of the Environment to control the problem of the disposal of liquid industrial wastes are reviewed including the way-bill system. The types and volumes of liquid wastes generated in Canada are tabulated. Using the way-bill system, the two parties to a disposal or transfer of liquid industrial waste are required to report independently to the Ministry. A voluntary way-bill system indicated that significant gains in the control and disposal of liquid industrial wastes could be achieved by making a regulation to document and control the movement of all liquid industrial wastes. Waste treatment and disposal technology is reviewed including: reclamation and/or recovery, re-use, incineration, incineration in cement kilns, deep-well disposal, solidification, landfilling, and treatment. (See also W79-07849) (Small-FRC)
W79-07856

PROCEEDINGS OF THE TWENTY-FIFTH SILVER ANNIVERSARY OF THE ONTARIO INDUSTRIAL WASTE CONFERENCE.
Held June 18-21, 1978 at Toronto, Ontario, (1978). 390 p. Ministry of the Environment, Ontario.

Descriptors: *Industrial wastes, *Pollution abatement, Filtration, Trickling filters, Dewatering, Creosote, Mining industry.

Twenty papers were presented at this conference on industrial waste abatement. Waste water treatment topics included ultrafiltration of oily water, a trickling filter for pretreatment of vegetable wastes, solidification of liquid industrial wastes, prevention of creosote contamination of groundwater, and the environmental controls practiced by Ontario's mining industry. 500 delegates attended the meetings. (See W79-07859 thru W79-07863) (Small-FRC)
W79-07858

MINING AND THE ENVIRONMENT - A QUARTER CENTURY IN REVIEW,
Ontario Mining Association, Toronto.
W. C. Ferguson.
In: Proceedings of the twenty-fifth Silver Anniversary of the Ontario Industrial Waste Conference, held June 18-21, 1978, Toronto, Ontario, p 2-21, (1978).

Descriptors: *Mineral industry, *Mining, *Mine water, *Mine wastes, Recycling, Waste water treatment, Heavy metals, Canada.

The environmental achievements of Ontario's mining industry are reviewed. More than 60 minerals are produced in about 300 operating mines in Canada; Ontario produces 40% or more than $2 billion in minerals each year. The three effluent disposal problems associated with mining are mine-water, tailings, and waste rock. Of the 193 million gallons of water per day used in Ontario mines, 111 million gallons are recycled. Treatment processes have reduced the heavy metals including copper, nickel, lead, and zinc discharged by the 53 active mines in Ontario to less than 1000 pounds per day. Reclamation and revegetation efforts are also reviewed. (See also W79-07858) (Small-FRC)
W79-07859

HYDROGEOLOGICAL CONTROL AND CLEAN-UP OF SOIL AND GROUNDWATER CONTAMINANTS AT NORTHERN WOOD PRESERVES, LTD,
G. E. Thompson.
In: Proceedings of the Twenty-fifth Silver Anniversary, Ontario Industrial Waste Conference, held June 18-21, 1978, Toronto, Ontario, p 250-268. (1978) 12 fig.

Descriptors: *Chemical industry, *Creosote, *Lake Superior, *Phenols, *Water quality control, Landfill, Runoff, Pilot plants, Activated carbon, Waste water treatment, Ozone.

Methods to prevent creosote contamination of Lake Superior by the Northern Wood Preservers, Ltd. plant in Thunder Bay are described. At the plant, wood products are treated with creosote, chromated copper arsenate, and pentachlorophenol. Some spilled creosote was washed directly into the lake by runoff, and the major portion infiltrated the landfill and moved laterally into the lake. The lake water had a high phenol content and creosote accumulated on the bottom. Northern Wood dredged the lake to remove the accumulated creosote. An investigation of the site led to the recommendation that well points be installed to prevent the movement of creosote to the lake. Pilot studies were conducted on the effluent which concluded that the most appropriate treatment for the effluent is ozonation or activated carbon. Two alternative treatment systems investigated consisted of an API separator, ozonation system, and gravity sand filter, or an API separator and a battery of activated carbon columns. (See also W79-07858) (Small-FRC)
W79-07860

PRETREATMENT OF VEGETABLE WASTEWATER AT THE H. J. HEINZ PLANT IN LEAMINGTON, ONTARIO,
Heinz (H. J.) Co. of Canada Ltd., Leamington (Ontario). Quality Assurance Dept.
D. Smit, and T. E. Eyre.
In: Proceedings of the Twenty-fifth Silver Anniversary of the Ontario Industrial Waste Conference, held June 18-21, 1978, Toronto, Ontario, p 269-275. (1978) 1 fig.

Descriptors: *Food processing industry, *Waste water treatment, *Trickling filters, *Packed beds, Aeration, Landfills, Biochemical oxygen demand.

Use of a roughing plastic media tower for the pretreatment of vegetable waste water is discussed. The waste water treatment plant consists of screening facilities, a 4 million gallon aeration basin with four 75 HP aerators and one 150 HP aerator, and a 1 million gallon circular clarifier. Sludge is concentrated and removed to a landfill. The tower was constructed to lower BOD during peak operations. It was constructed out of plastic media to a height of 12 ft, with an overall size of 32 x 32 ft. The total waste flow in the plant is kept below 3 million Imperial gallons per day and 25% of the flow is pretreated in the tower. With the new system, COD removal was only about 20% due to scouring by sand caused by machine-picked crops. A settling basin is being installed to remove the sand. More pretreatment towers are planned at this plant. (See also W79-07858) (Small-FRC)
W79-07861

TREATMENT AND RECOVERY OF EMULSIFIED OIL BY ULTRAFILTRATION,
Electrhome Ltd., Kitchener (Ontario).
G. Dhawan.
In: Proceedings of the Twenty Fifth Silver Anniversary of the Ontario Industrial Waste Conference, held June 18-21, 1978, Toronto, Ontario, p 276-291, 1978. 8 fig.

Descriptors: *Filtration, *Oily water, *Recycling, *Separation techniques, Waste water treatment, Costs, Emulsifiers.

An ultrafiltration plant is described which was developed by Electrohome Ltd., and which has been operating at Budd Automotive, Kitchener, Ontario, since 1976. The plant treats oil water from washers, and the oil concentration varies from 0-5%. The ultrafiltration system removes oil continuously and maintains a washer oil concentration under 5%. After settling, the concentrated oil has a final oil concentration of 70-90%. The water from the ultrafiltration system contains most of the emulsifiers used in the washers and it is recycled to the washers. A payback of less than two years is realized by savings in oil, elimination of waste disposal costs, and reduction in the washer clean-up. (See also W79-07858) (Small-FRC)
W79-07862

SOLIDIFICATION OF WASTES,

D. Krofchak.
In: Proceedings of the Twenty-fifth Silver Anniversary, Ontario Industrial Waste Conference, held June 18-21, 1978, Toronto, Ontario, p 378-390. (1978) 6 fig, 1 tab, 4 ref.

Descriptors: *Waste disposal, *Industrial wastes, *Landfills, *Leachate, *Dewatering, Heavy metals, Water pollution sources.

Solidification of wastes was evaluated on liquid wastes from various industrial sources. Industrial wastes were unloaded into either of two 125,000 gallon holding lagoons. A third 100,000 lagoon was used to blend waste prior to solidification treatment. Solidification was performed in 3500 gallon batches. Alkaline and silicate reagents were added to the waste in a blender, and the resulting slurry was fed to the reaction tank. The solidified product was cured for several days and then removed to a landfill. The stability of 10 solidified samples was evaluated with respect to environmental attack by aqueous solutions in a series of 25 leaching tests. Column leaching flow tests were run for 8-26 days while constant volume leaching tests were run for 9-13 days. Concentration of heavy metals was generally less than 1 ppm for individual metals. These elements include Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Ti, V, and Zn. (See also W79-07858) (Small-FRC)
W79-07863

CONFERENCE ON MUSKEGON COUNTY, MICHIGAN WASTEWATER SYSTEM, SEPTEMBER 17-18, 1975, A CRITICAL REVIEW ON EVALUATIONS OF THE SYSTEM AND IDENTIFICATION OF NEEDED RESEARCH,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 552, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-905/9-76-006, 1976. 178 p.

Descriptors: *Irrigation systems, *Experimental farms, *Performance, *Waste water treatment, Municipal wastes, Industrial wastes, Design, Costs, Agricultural engineering, Michigan.

The Muskegon County waste water treatment system was reviewed and evaluated. The operation of the municipal-industrial collection system, an aeration system, holding lagoons, and a spray irrigation system are discussed. Progress is outlined from 1969 through 1975. Topics discussed include agricultural engineering, agricultural management of waste water utilization, soil monitoring, and modeling and economic studies. Participants included principal investigators and government representatives. (See W79-07865 and W79-07866) (Small-FRC)
W79-07864

REVIEW OF SYSTEM DESIGN PARAMETERS,
Bauer (W. J.) Consulting Engineers, Chicago, IL.
W. J. Bauer.
In: Conference on Muskegon County, Michigan Wastewater System, September 17-18, 1975, A Critical Review on Evaluations of the System and Identification of Needed Research, p 44-55. 1976.

Descriptors: *Irrigation systems, *Experimental farms, *Design, *Performance, Land clearing, Municipal wastes, Waste water treatment, Costs, Biochemical oxygen demand, Michigan.

The Muskegon County waste water irrigation project experiences during startup are described and related to the original design considerations. The flow was estimated to average 28.5 MGD which was very near the actual flow. BOD is somewhat less than that assumed in the design resulting in less demand than expected for aeration. Problems were encountered with failures in insulation of buried electrical cables, with failures of asbestos cement pressure pipes, and with clogging of nozzles with vegetation and sand. Most of the problems were caused by substandard workmanship, although some are related to design criteria. Problems were also encountered with the clearing of trees, because air pollution regulations made burning of the cleared trees impossible. The water quality objectives of the system were accomplished. In 1975, operating costs were forecast to be $1.4 million to be offset by a crop sales revenue of about $1 million. The net cost per gallon treated would then be $40 per million gallon. (See also W79-07864) (Small-FRC)
W79-07865

PERFORMANCE AND ECONOMICS OF THE SYSTEM,
Muskegon County Wastewater Management System, MI.
Y. A. Demirjian.
In: Conference on Muskegon County, Michigan Wastewater System, September 17-18, 1975, A Critical Review on Evaluations of the System and Identification of Needed Research, p 56-72. 1976 3 fig, 11 tab.

Descriptors: *Irrigation systems, *Experimental farms, *Biochemical oxygen demand, *Nitrogen, *Performance, Phosphate, Coliforms, Costs, Municipal wastes, Waste water treatment, Michigan.

The Muskegon, Michigan waste water treatment system which utilizes land application at an 11,000 acre site, is evaluated. The system reduces BOD over 98% and COD drops from 550 ppm to 30-40 ppm. This reduction occurs during storage and aeration. Total nitrogen is reduced from 15 ppm to 2.5 ppm, and phosphate is reduced by 97%. The systems meets NPDES discharge limits except for fecal coliform. This is thought to be due to contamination by waterfowl. Actual costs for aeration were $216,000, for storage were $62,000, and for irrigation were $250,000 per year. Problems were encountered with sand and vegetation clogging of irrigation nozzles. A sump will be added to remove sand and screens will be used to eliminate vegetation and other debris. The crop yield in 1975 was double 1974 levels. (See also W79-07864) (Small-FRC)
W79-07866

SCREENING/FLOTATION TREATMENT OF COMBINED SEWER OVERFLOWS. VOLUME I - BENCH SCALE AND PILOT PLANT INVESTIGATIONS,
Envirex, Inc., Milwaukee, WI.
M. K. Gupta, D. G. Mason, M. J. Clark, T. L. Meinholz, and C. A. Hansen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 834, Price codes: A13 in paper copy, A01 in microfiche. Report EPA-600/2-77-069a, 1977. 295 p, 38 fig, 117 tab, 71 ref, 6 append.

Descriptors: *Screens, *Flotation, *Combined sewers, *Overflow, Outfall sewers, *Pilot plants, Suspended solids, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment, Municipal wastes.

The treatment of combined sewer overflows by a combined screening and dissolved-air flotation system was evaluated in laboratory tests and in two 5 mgd pilot plants. Laboratory tests evaluated chemical oxidation, screening, dissolved-air flotation, and disinfection as treatments for combined sewer overflows containing particulate pollutants; chemical oxidation was not considered feasible. A pilot screening and dissolved-air flotation facility incorporating one drum screen was established at an outfall and handled a total of 63 combined sewer overflows. The pilot plant achieved BOD, COD, and suspended solids removals in the range of 60-75%. Another sequential screening plant with three drum screens in series was also operated at the outfall and accomodated 21 combined sewer overflows. The plant achieved about 30% reduction of suspended solids, volatile suspended solids, BOD, COD, and total organic carbon. No significant improvements in removal efficiencies were observed when chemical flocculants were added or when the hydraulic and solids loadings varied. No significant improvements were obtained in the screening/flotation plant when it was operated in an effluent flow pressurization mode or with powdered activated carbon. Removal efficiency was improved by 5-10% when the effluent was polished with 22 micron microscreening. (Lisk-FRC)
W79-07867

MANUAL FOR THE CONTROL OF HAZARDOUS MATERIAL SPILLS. VOLUME ONE. SPILL ASSESSMENT AND WATER TREATMENT TECHNIQUES,
Envirex, Inc., Milwaukee, WI. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W79-07868

SEPARATION OF ALGAL CELLS FROM WASTEWATER LAGOON EFFLUENTS, VOL. III: SOIL MANTLE TREATMENT OF WASTEWATER STABILIZATION POND EFFLUENT - SPRINKLER IRRIGATION,
Utah Water Research Lab., Logan.
B. T. Hicken, R. S. Tinkey, R. A. Gearheart, J. H. Reynolds, and D. S. Filip.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 537, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/2-78-097, 1978. 233 p, 33 fig, 30 tab, 100 ref, 3 append.

Descriptors: *Waste water treatment, *Land use, *Irrigation practices, *On-site investigations, *Performance, Lysimeters, Leaching, Suspended solids, Nitrates, Phosphorus, Ammonia, Application methods, Coliforms, Utah.

The efficiency of sprinkler irrigation wastewater treatment was evaluated by lysimeter studies and a two-year field study as a means of polishing waste water stabilization lagoon effluent. In the lysimeter study, four Utah soils were evaluated for their effectiveness in removing total coliform and fecal streptococcal organisms as well as nitrogen, phosphorus, and carbon compounds. The removal efficiencies for carbon, nitrogen, and phosphorus compounds were evaluated in field experiments. All four soils were found to be effective in removing three indicator organisms, organic compounds, and suspended solids. Leaching of salts from soils occurred during the field experiments on a drainage farm. The characteristics of the drainage farm system appeared to control the quality of the effluent. Superior quality is expected once equilibrium is established. In the field experiments, phosphorus removal exceeded 80%. The rate of waste water application made no significant difference in the phosphorus removal rate. There was evidence of nitrate leaching from the soil. Ammonia stripping removed about 35% of the ammonia when the lagoon effluent was sprayed on the land. Excellent suspended solids removal was effected by the soil mantle treatment system. The suspended solids concentrations in the drainage water from a 1.2 m deep mole drain contained an average suspended solids concentration of 2 mg/liter. (Small-FRC)
W79-07870

DESTROYING CHEMICAL WASTES IN COMMERCIAL SCALE INCINERATORS. FACILITY REPORT NUMBER 3 - SYSTEMS TECHNOLOGY,
TRW Defense and Space Systems Group, Redondo Beach, CA.
D. G. Ackerman, J. F. Clausen, R. J. Johnson, and C. A. Zee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 540, Price codes: A05 in paper copy, A01 in microfiche. Report, 1977. 96 p, 13 fig, 39 tab, 4 ref, 4 append.

Descriptors: *Chemical wastes, *Phenols, *Incineration, *Ultimate disposal, *Aqueous solutions, Cost analysis, Capital costs, Operating costs, Industrial wastes, Waste water treatment.

The incineration of two liquid industrial waste streams in a fluidized bed incinerator was evaluated. The waste streams were an aqueous phenol sludge and an aqueous solution of methyl methacrylate monomer. The effects of operating and equipment variables were determined by performing the incinceration tests at two different flow rates. The process achieved a destruction efficiency of more than 99.999% of each waste material, as indicated by the analysis of combustion gas samples. No organics could be detected in the scrubber water or ash and stack emissions were analyzed for particulate loading and composition.

capital cost of $6 million and an operating cost f $255/metric ton were estimated for destroying 3.2 million liters/yr of aqueous methyl methacryte. Incineration of 23.8 million liters/yr of aqueus phenol waste would cost an estimated $6 million capital investment and $124/metric ton operatg cost. (Lisk-FRC)
/79-07871

DESTROYING CHEMICAL WASTES IN COMMERCIAL SCALE INCINERATORS. FACILITY REPORT NUMBER 1 - THE MARQUARDT COMPANY,
TRW Defense and Space Systems Group, Redono Beach, CA.
F. Clausen, R. J. Johnson, and C. A. Zee.
Available from the National Technical Information ervice, Springfield, VA 22161 as PB-265 541, rice codes: A06 in paper copy, A01 in microfiche. eport, 1977. 127 p, 27 fig, 39 tab, 4 append.

Descriptors: *Chemical wastes, *Incineration, *Ulmate disposal, *Aqueous solutions, *Effluent treams, Cost analysis, Capital costs, Operating osts, Waste water treatment, Industrial wastes.

The incineration of two liquid industrial waste treams, ethylene manufacturing waste and exachlorocyclopentadiene (C-5,6) was investigatd. The ethylene wastes were combusted at three ifferent temperatures while the C-5,6 wastes, hich required auxiliary fuel for incineration, were urned at three different fuel/waste ratios to deterine the effects of normal operating and equipent variables. Destruction efficiencies of more han 99.999% were achieved for each waste conituent. No increase in organics was detected in he scrubber water. Particulate loading and comosition of the stack emissions were analyzed with Standard EPA Method 5 tests. No chlorinated rganics were found in the burner head residue ormed during incineration of the wastes. Liquid njection incineration of the wastes was considered ffective, but rotary kiln incineration was considred more suitable for C-5,6 waste because of tarry esidual. A capital cost of $1.8 million and an nnual operating cost of $1.0 million were estimatd for the destruction of an annual load of 15 million kg of ethylene waste. Incineration of 4.5 million kg/yr of C-5,6 would cost an estimated 1.6 million capital investment and $2.2 million/yr perating costs. (Lisk-FRC)
W79-07872

PHYSICAL, CHEMICAL, AND BIOLOGICAL TREATMENT TECHNIQUES FOR INDUSTRIAL WASTES. VOLUME 1,
Little (Arthur D.), Inc., Cambridge, MA.
J. B. Berkowitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 054, Price codes: A21 in paper copy, A01 in microfiche. Report, 1977. 474 p, 56 fig, 76 tab, 406 ref.

Descriptors: *Treatment, *Industrial wastes, *Evaluation, *Performance, *Biological treatment, Adsorption, Catalysts, Centrifugation, Chlorination, Dialysis, Distillation, Electrodialysis, Electrolysis, Electrophoresis, Freeze drying, Waste water treatment.

The suitability of 47 unit engineering processes in the treatment of hazardous industrial wastes was investigated. Some of the treatment processes are already in use while others require further research and development before they will be commercially attractive. Descriptions of the unit processes and data on their basic principles, areas of application, economics, energy and environmental considerations, and the future outlook for use on industrial wastes are provided. The treatment processes in this volume include 2 adsorption processes, 7 biological treatments, calcination, catalysis, centrifugation, chlorinolysis, dialysis, dissolution, distillation, electrodialysis, electrolysis, and electrophoresis. Process evaluations are continued in Volume II of the report. Dialysis, electrophoresis, freeze drying, and zone refining were not suitable for the treatment of hazardous industrial wastes. (Lisk-FRC)
W79-07873

HIGHLIGHTS OF THE CLEAN WATER ACT OF 1977,
M. P. Kerner.
Environmental Law, Vol. 8, No. 2, p 869-85, 1978.

Descriptors: *Federal water pollution control act, *Federal government, *Water pollution, Dredging, Oil spills, Industries, Waste water treatment, Taxes, Sewage treatment, Industrial wastes.

Amendments to the 1972 Federal Water Pollution Control Act Amendments (FWPCA), passed by Congress on December 15, 1977, were signed by President Carter on December 28, 1977. The amendments change the name of the FWPCA to the 'Clean Water Act' and reconcile the conflicting provisions of the House and Senate bills. The amendments are basically revisional, allowing for some flexibility in meeting various requirements and time limits of the FWPCA. Those areas where deadlines have been extended are identified: (1) 1977 'Best Practicable Control Technology Currently Available' deadline extensions for industrial dischargers; (2) 1977 secondary treatment deadline extensions for municipal waste treatment facilities; and (3) 1983 'Best Available Technology Economically Achievable' deadline extension for industrial dischargers. Also identified and discussed are new provisions in the following areas: (1) Army Corps of Engineers jurisdiction over dredge and fill materials; (2) Federal facility compliance; (3) oil spill liability; (4) best management practices for industry; (5) irrigation return flows:; (6) secondary treatment requirements for municipal waste treatment dischargers; (7) funding authorization for existing sewer system rehabilitation; (8) federal funding for individual waste treatment facilities; (9) ad valorum taxes; and (10) alternative waste treatment. (Vloedman-Florida)
W79-07874

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: STATE ANALYSES VOLUME II,
Wisconsin Univ.-Madison. School of Law.
For primary bibliographic entry see Field 6E.
W79-07876

FLOOD PLAIN DEVELOPMENT PRESSURES AND FEDERAL PROGRAMS-PART 1-CASE STUDY ANALYSIS AND RECOMMENDATIONS FOR THE '201' WASTEWATER TREATMENT WORKS PROGRAM,
Research Group, Inc., Atlanta, GA.
For primary bibliographic entry see Field 6E.
W79-07877

THE ECONOMIC IMPACT OF ALTERNATIVE CYANIDE STANDARDS IN ILLINOIS,
IIT Research Inst., Chicago, IL.
For primary bibliographic entry see Field 6E.
W79-07885

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

GROUND AND SURFACE WATER IN NEW MEXICO: ARE THEY PROTECTED AGAINST URANIUM MINING AND MILLING,
For primary bibliographic entry see Field 6E.
W79-07896

THE RISING COSTS OF MINE DRAINAGE ABATEMENT,
Maryland Dept. of Natural Resources, Annapolis. Energy and Coastal Zone Administration.
A. F. Abar.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 109-111. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Coal mine wastes, *Mine drainage, *Acid mine water, *Water pollution sources, *Pollution abatement, *Costs, Capital costs, Estimates costs, Water pollution treatment, Abatement, Water quality control, Water purification, Georges Creek River basin project(Maryland).

Acid mine drainage (AMD) continuously impacts about 4,275 miles of the Susquehanna, Allegheny, Delaware, Monongahela, and Potomac River basins. In considering abatement program costs, statistics concerning mine drainage sources are more important than those concerning the extent of AMD. Abandoned mines produce 80% of all AMD in the Appalachian Region, and more than 80% of the AMD from all abandoned mines is produced by deep abandoned mines. The solutions and costs are complex, and demonstrate the need for a publicly funded AMD pollution abatement program. According to a 1969 study conducted by the Appalachian Regional Commission, the capital costs of controlling AMD are estimated at $6.6 billion. Abatement program costs are incurred before project construction is actually intiated, because field reconnaissance is necessary to locate AMD sources from deep abandoned mines. The Georges Creek River basin project in Allegheny and Garrett Counties in Maryland is discussed as an example of the complexity of the abatement program. Techniques developed to eliminate or reduce AMD are generally preventive measures to inhibit AMD formation, or treatment measures which capture and treat AMD after its formation and discharge from the mine. Current mining operations are eliminating many abandoned mine problems by mining and reclaiming adjacent areas; this includes daylighting deep mines and reclamation of surface-mined land. Recent legislation passed in Maryland imposes a 15 cent per ton surcharge on all coal mined in the State, which provides a cash flow to cover recurring costs. (Davison-IPA)
W79-07977

IMPACT OF WASTEWATER TREATMENT PLANT DISCHARGES,
Maryland Univ., College Park. Inland Environmental Lab.
For primary bibliographic entry see Field 5C.
W79-07985

5E. Ultimate Disposal Of Wastes

LONG-TERM EFFECTS OF LAND APPLICATION OF DOMESTIC WASTEWATER: HOLLISTER, CALIFORNIA, RAPID INFILTRATION SITE,
Metcalf and Eddy, Inc., Palo Alto, CA.
C. E. Pound, R. W. Crites, and J. V. Olson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 405, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-084, April 1978. 166 p, 42 fig, 64 tab, 96 ref, 3 append. 68-03-2361.

Descriptors: *Waste water disposal, *Infiltration, *Percolation, Trace elements, Groundwater recharge, Soil chemistry, Flooding, Effluents, Municipal wastes, Liquid wastes, Water table, Infiltration galleries, Settling basins, Hollister(California).

The effects of more than 30 years application of primary treated municipal waste water to a rapid infiltration site were evaluated by analyzing groundwater and soil chemistry at the site. The current daily flow at the Hollister, California, infiltration basins is 43.8 L/s (1.0 M gal/day). The 20 infiltration basins are flooded for one to two days every 14 to 21 days, depending on the size of the basin and the season; annual waste water application equal 15.4 m, or 51 ft/basin. Water table response to the applications was monitored, infiltration rates were determined, and subsurface hydrology was logged. Samples from the one-year analysis program included: (1) primary effluent, (2)

on-site and control site soil profiles, (3) groundwater at the site and upgradient and downgradient of groundwater movement from the site. Results of the primary effluent and groundwater analyses indicated that percolation through 22 ft of unsaturated gravelly, sandy loam effectively reduced COD, BOD, TOC, nitrogen, and fecal coliform bacteria. Although effective phosphorus removal required longer travel distances, the soil sorption capacity has not been exceeded. Soil retention of trace elements was low, and only lead exceeded EPA drinking water limits in the waste water and the shallow groundwater aquifer. Slight boron removal in the percolate was observed; iron and manganese are being leached from the soil with the percolating waste water. (Davison-IPA)
W79-07512

ORGANIC COMPOUNDS IN ORGANOPHOSPHORUS PESTICIDE MANUFACTURING WASTEWATERS,
Midwest Research Inst., Kansas City, MO.
M. Marcus, J. Spigarelli, and H. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 821, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-056, September 1978. 141 p, 55 fig, 22 tab, 9 ref, 2 append. 68-03-2343.

Descriptors: *Organophosphorus pesticides, *Organic pesticides, *Industrial wastes, *Pesticide removal, *Waste water treatment, Waste treatment, Effluents, Water pollution sources, Water pollution, Water quality, Water quality control, Liquid wastes, Organic compounds.

The nature of organophosphorus pesticide manufacturing plant effluents was studied to develop preliminary survey information on the waste water streams of this industry, and to develop analytical methods for monitoring compound levels present in these streams. In addition to identifying and quantifying organophosphorus compounds, nonphosphorus chemicals were included in the survey. Samples of diazinon, methyl parathion, azinophosmethyl and disulfoton, fonofos, phosmet and bensulide, and EPN were taken at pre-, mid-, and post-treatment locations from five pesticide plants. These samples were analyzed utilizing extraction and partitioning, gas chromatography with specific element detection, thin-layer chromatography, infrared spectroscopy, and gas chromatography/mass spectrometry. Among the 116 compounds identified were: organophosphorus pesticides, related organophosphorus esters, organophosphorus acids, thiocarbamate pesticides, and triazine herbicides. Final effluent levels of organophosphorus pesticides were generally below 0.005 mg/liter, indicating effective removal by the waste treatment systems studied. Oxygen analogs of the pesticides were not a significant degradation product of any of the treatment processes. Organophosphorus acids were only partially removed by the treatment systems, and methyl phosphorothioates actually increased in concentration during treatment, possibly indicative of biomethylation of phosphorothioic acids. (Davison-IPA)
W79-07513

ASSESSMENT OF LOW-GROUND-PRESSURE EQUIPMENT FOR USE IN CONTAINMENT AREA OPERATION AND MAINTENANCE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
W. E. Willoughby.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 501, Price codes: A06 in paper copy, A01 in microfiche. Technical Report DS-78-9, July 1978. 106 p, 11 fig, 3 ref, 2 append.

Descriptors: *Equipment, *Operation and maintenance, *Dredged material disposal, *Containment areas, *Low-ground-pressure equipment, Soft soils.

Guidelines for the selection of equipment to operate in and around confined dredged material disposal areas were developed as part of the Dredged Material Research Program (DMRP). In the early phase of the DMRP, it was recognized that, in order to implement concepts for management of disposal areas to minimize adverse environmental impacts, equipment must be employed that can operate on very soft soils. In a three-phase study, guidelines were developed (a) compiling a catalog of low-ground-pressure equipment, (b) analytically predicting vehicle performance, and (c) verifying the predictions of the field condition. This report is a synthesis of the three studies. The equipment catalog is included as Appendix A. Guidance for performing required soils tests is contained in Appendix B. (WES)
W79-07520

THE AGRICULTURAL VALUE OF DREDGED MATERIAL,
Science and Education Administration, St. Paul, MN. North Central Region.
S. C. Gupta, W. E. Larson, R. G. Gast, S. M. Combs, and R. H. Dowdy.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 298, Price codes: A08 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-36, July 1978. 165 p, 44 fig, 26 tab, 74 ref, 3 append.

Descriptors: *Agricultural engineering, Agriculture, *Dredged material, Sediment analysis.

To study the suitability of dredged material for crop production, 10 dredged material samples and 10 marginal soil samples were collected from locations in the United States. The soils were marginal for crop production and were of such character that additions of dredged material might improve their physical and chemical properties. The soils and dredged material samples were dried, ground, and mixed for plant growth studies and laboratory analysis. These treatments were prepared: (a) soil alone; (b) 1/3 soil and 2/3 dredged material; (c) 2/3 soil and 1/3 dredged material; and (d) dredged material alone. Three productive soils were chosen from the St. Paul, Minn., area as controls. Three cuttings of ryegrass and two crops of barley were harvested from each treatment. Greenhouse yields were greater for all fine-textured dredged material samples compared to coarse-grained marginal soils. Results show that the dredged material used in this study may increase agricultural production when mixed with marginal soils. Relationships between uptake and the availability of various soil elements were developed for setting the ratio of dredged material to marginal soil used in the field. Physical and chemical data, along with plant growth data, were used to develop guidelines for disposing dredged material on marginal soils. (WES)
W79-07521

EFFECTS OF SUSPENDED DREDGED MATERIAL ON AQUATIC ANIMALS,
California Univ., Bodega Bay. Bodega Marine Lab.
R. K. Peddicord, and V. A. McFarland.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 489, Price codes: A06 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-29, July 1978. 115 p, 3 append, 11 tab, 39 fig, 55 ref.

Descriptors: *Aquatic animals, *Suspended load, Sediments, *Dredged material.

Evaluates the impact of suspensions of relatively uncontaminated and contaminated harbor sediments on juvenile and adult marine, estuarine and freshwater fish and invertebrates. Studies of survival and tissue accumulation of contaminants were conducted for 21 days exposure to suspended sediments in a flow-through aquarium system. Even the most sensitive fish survived days of continuous exposure to suspensions of relatively uncontaminated sediment on the order of grams per litre, and the invertebrates generally survived similar exposures to tens of grams per litre of relatively uncontaminated sediment. Exposure to suspensions of contaminated sediment decreased survival substantially, but mortality occurred only after exposure to higher concentrations for longer time periods than are created in the water column by the typical dredging operation. Only fingerling striped bass Morone saxatilis showed a sensitivity great enough to indicate potential cause for concern from continuous pipeline discharge of highly contaminated dredged material. While water column impacts appeared to warrant little concern, data indicate potential for impact of contaminated fluid mud on benthic infauna and relatively immobile epifauna. Fluid muds with suspended sediment concentrations of tens of grams per litre can persist for sufficient periods to have potential impact on immobile bottom dwellers. (WES)
W79-07523

FIELD INVESTIGATIONS OF THE NATURE, DEGREE, AND EXTENT OF TURBIDITY GENERATED BY OPEN-WATER PIPELINE DISPOSAL OPERATIONS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. R. Schubel, H. H. Carter, R. E. Wilson, W. M. Wise, and M. G. Heaton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 507, Price codes: A14 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-30, July 1978. 297 p, 4 append, 130 fig, 37 tab, 66 ref.

Descriptors: *Turbidity, Suspended solids, *Dredged material, *Dredged material disposal, *Open water disposal, Plumes, Environmental effects.

Characteristics of turbidity plumes near open-water pipeline disposal operations are evaluated. Distribution and concentration of dissolved heavy metals, nutrients, and dissolved oxygen also are evaluated. Based on field studies at Corpus Christi Bay, Texas, Atchafalaya Bay, Louisiana, and Apalachicola Bay, Florida, a simple model was developed to predict 61 spatial and temporal distributions of suspended solids in turbidity plumes. No well-defined plumes of dissolved metals were observed at sites, indicating dissolution of metals from suspended solids was limited. Increased concentrations of suspended solids and particle-associated metals in receiving waters was associated with discharge plume. Concentrations of dissolved ammonia and silica increased near discharge; however, no increases in dissolved phosphate were noted, despite high dissolved phosphate concentrations in interstitial water of channel sediment being dredged. Elutriate test results using channel sediment had limited use predicting changes in concentrations of dissolved metals during open-water disposal operations. A simple model was developed to predict concentrations of particle-associated constituents. Although large quantities of reduced sediment with high oxygen demand enter the water column during open-water pipeline disposal operations, little is reactive on a time scale comparable to that associated with majority settling of dredged material slurry. (WES)
W79-07524

AQUATIC DISPOSAL FIELD INVESTIGATIONS ASHTABULA RIVER DISPOSAL SITE, OHIO, APPENDIX C, INVESTIGATION OF WATER-QUALITY AND SEDIMENT PARAMETERS,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
For primary bibliographic entry see Field 5C.
W79-07525

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, BUTTERMILK SOUND MARSH DEVELOPMENT SITE, ATLANTIC INTRACOASTAL WATERWAY, GEORGIA; SUMMARY REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. A. Cole.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A057 937, Price codes: A03 in paper copy, A01 in microfiche. Technical Report D-78-26, July 1978. 34 p, 2 tab, 9 ref.

escriptors: *Habitats, *Marshes, *Dredged mate-
al, *Waste disposal sites, *Buttermilk
ound(Georgia), *Habitat development.

summary is presented of activities that occurred
uring the habitat development field investigation
Buttermilk Sound near the mouth of the Altama-
a River in Glynn County, Georgia, between 1975
d 1977. A general discussion of salt marsh propa-
ation, microbial development, and associated
imal responses is included. Detailed information
garding habitat development at this site is pre-
nted in Appendix A to this report. (WES)
79-07526

ANDBOOK FOR TERRESTRIAL WILDLIFE ABITAT DEVELOPMENT OF DREDGED IATERIAL,
cean Data Systems, Inc., Wilmington, NC.
oastal Zone Resources Div.
vailable from the National Technical Information
ervice, Springfield, VA 22161 as AD-A061 114,
ice codes: A17 in paper copy, A01 in microfiche.
rmy Engineer Waterways Experiment Station,
icksburg, Mississippi, Technical Report D-78-37,
ly 1978. 391 p, 2 tab, 109 fig, 3 append, 177 ref,
b.

escriptors: *Terrestrial habitats, *Wildlife habi-
ts, *Dredged material, *Habitat development.

his study of terrestrial wildlife habitat develop-
ent on dredged material within the contiguous
nited States compiles existing published and un-
blished data into a user-oriented handbook. A
neral list of 250 plant species with food and
ver value for wildlife is indexed by life form and
ate; a synopsis is given for each of 100 plant
ecies chosen from the general list on the basis of
eir importance to wildlife, ease of establishment,
d geographic distribution. Each synopsis in-
udes a description and discussion of habitat, soil
quirements, establishment and maintenance, dis-
se and insect problems, and wildlife value. A
nge map and illustrations are given along with
propriate miscellaneous comments. The hand-
ok also outlines a suggested approach for devel-
ing terrestrial wildlife habitat on dredged mate-
l; discusses wildlife species inhabiting dredged
aterial areas; and recommends techniques for
opagation, establishment, and maintenance of
antings. (WES)
79-07527

FIELD STUDY OF FLUID MUD DREDGED ATERIAL: ITS PHYSICAL NATURE AND ISPERSAL,
irginia Inst. of Marine Science, Gloucester Point.
. M. Nichols, G. S. Thompson, and R. W. Faas.
vailable from the National Technical Information
ervice, Springfield, VA 22161 as AD-A058 952,
ice codes: A05 in paper copy, A01 in microfiche.
rmy Engineer Waterways Experiment Station,
icksburg, Mississippi, Technical Report D-78-40,
ly 1978. 84 p, 1 append, 5 tab, 28 fig, 21 ref.

escriptors: *Mud, *Dispersion, Turbidity,
Mobile Bay(Ala), *James River(Va), *Fluid mud,
Dredged material, *Open water disposal.

pen-water disposal of dense suspensions of fluid
ud with concentrations of 10 to 480 g/l was
udied at field sites in Mobile Bay, Alabama, and
e James River, Virginia. The significance of fluid
ud in dispersal of dredged material and in genera-
on of turbidity was examined. The bulk of the
edged material, more than 99 percent at the
obile Bay site, was dispersed in the form of fluid
ud near the bottom, whereas less than 1 percent
as dispersed through the water column. As sus-
nded solids flocculate and settle, they contribute
the fluid mud. In turn, fluid mud resists resu-
ension and reduces turbidity. Disposal created a
eposit spread over an area 5 to 13 times the
edged area in the channel. Disposal raised the
d, forming dense layers in mounds 0.8 to 2.2 m
gh having slopes 1:125 to 1:2000. After disposal,
e fluid mud consolidated, bulk density increased,
d slopes decreased. Height and volume of the
mes River mound decreased about 50 percent in
year. More field investigations of the movement of fluid mud are needed for a detailed understanding of its dynamics. (WES)
W79-07528

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, PORT ST. JOE SEAGRASS DEMONSTRATION SITE, PORT ST. JOE, FLORIDA; SUMMARY REPORT,
Seattle Pacific Univ., WA.
R. C. Phillips, M. K. Vincent, and R. T. Huffman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 733, Price codes: A04 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Technical Report D-78-33, July 1978. 52 p, 7 tab, 5 fig, 1 app, 20 ref.

Descriptors: *Habitats, Plant growth, *Dredged material, *Seagrasses, *Habitat development, *Port St. Joe(Fla.).

Transplants of shoal grass (Halodule wrightii) at Port St. Joe, Florida, indicate that it may be feasible to propagate seagrass on dredged material. Using the plug technique, two sizes of plugs were removed from a natural meadow and planted on coarse-grained dredged material at three different spacing intervals. Many of the transplants demonstrated a siginificant amount of growth before the project failed nearly 13 months after planting. Best growth was obtained with 375-cm2 plugs planted on 0.9-m centers. The reason for the project failure is not known, but it is hypothesized that the factors involved included stresses from an unusually cold winter, exposure, erosion, sedimentation, variation in water quality, and heavy surf. While the study indicates that seagrass propagation on dredged material has promise, further field study is needed. (WES)
W79-07531

MICROBIOLOGICAL STUDIES ON THE NITROGEN CYCLE IN AQUATIC ENVIRONMENTS - V NITROGEN METABOLISM IN THE GOLDFISH CULTURING POND,
Kyoto Univ., (Japan). Research Inst. for Food Science.
For primary bibliographic entry see Field 5B.
W79-07592

NITROGEN AND PHOSPHORUS REMOVAL FROM SEWAGE EFFLUENT WITH HIGH SALINITY BY CHORELLA SALINA,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W79-07643

DEMONSTRATION OF A LEACHATE TREATMENT PLANT,
Applied Technology Associates, Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W79-07775

COST OF LANDSPREADING AND HAULING SLUDGE FROM MUNICIPAL WASTEWATER TREATMENT PLANTS. CASE STUDIES,
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
R. K. Anderson, B. R. Weddle, and T. Hillmer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 875, Price codes: A08 in paper copy, A01 in microfiche. Report EPA/530/SW-619, 1977. 149 p, 13 fig, 6 tab, 1 append.

Descriptors: *Ultimate disposal, *Municipal wastes, *Sludge disposal, *Costs, *Dewatering, Filtration, Waste water treatment, Personnel, Agricultural, Land use, Application methods.

The cost of disposing of municipal wastewater treatment sludge on land by existing operations was investigated by an on-site survey of 24 communities. The municipal plants surveyed were small to medium in size with throughputs of less than 100 mgd. A cost analysis indicated that landspreading liquid sludge was far less expensive than landspreading sludge dewatered by vacuum filtration. Communities that disposed of liquid sludge had an average cost of $32.00 per dry ton, while those that dewatered their sludge averaged $87.00 per dry ton. Personnel costs represented the largest single cost item for both liquid and dewatered sludge landspreading. Liquid sludge was more acceptable to farmers than dewatered sludge because the municipality spread the liquid sludge. Dewatered sludge was more difficult to spread. (Small-FRC)
W79-07777

TREATMENT AND STABILIZATION OF POLYCHLORINATED BIPHENYLS (PCBS) CONTAMINATED WATER AND WASTE OIL-A CASE STUDY. WHITEHOUSE, FLORIDA,
Environmental Protection Agency, Atlanta, GA. Region IV.
For primary bibliographic entry see Field 5D.
W79-07778

LINER MATERIALS EXPOSED TO HAZARDOUS AND TOXIC SLUDGES,
Matrecon, Inc., Oakland, CA.
For primary bibliographic entry see Field 8G.
W79-07779

ON-LAND DISPOSAL OF MUNICIPAL SEWAGE SLUDGE: A GUIDE TO PROJECT DEVELOPMENT (INTERIM REPORT),
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
M. H. Lutkin, J. L. Smith, and D. B. McWhorter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 144, Price codes: A07 in paper copy, A01 in microfiche. Report NSF/RA-770165, 1977. 151 p, 12 fig, 14 tab, 93 ref, 2 append.

Descriptors: *Sewage sludge, *Sludge disposal, *Land management, *Application methods, *Treatment facilities, Design criteria, Design data, Project planning, Municipal wastes.

A technique for planning a land application facility for municipal sewage sludge disposal was developed. A literature review of pertinent background material included an overview of permits and approval processes; pathogenic microorganisms; inorganic and organic contaminants; potential surface conditions at a field location; a discussion of potential subsurface conditions, including groundwater and soil water movement, soil properties, and procedures for obtaining data; and the impact of climate and sludge application on operation. Important factors in project development were identified and practical data from existing operations were utilized to provide guidelines for site selection, overall design, and monitoring techniques. The application of the data by a designer or administrator for developing a land application facility was demonstrated with a hypothetical project. (Lisk-FRC)
W79-07780

ASSESSMENT IN INDUSTRIAL HAZARDOUS WASTE MANAGEMENT PETROLEUM RE-REFINING INDUSTRY,
J. W. Swain.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 267, Price codes: A08 in paper copy, A01 in microfiche. Report, 1977. 160 p, 3 fig, 44 tab, 30 ref, 6 append.

Descriptors: *Oil industry, *Landfills, *Leachate, *Neutralization, *Cooling water, Sludge, Lead, Zinc, Phenols, Waste disposal, Waste water treatment, Industrial wastes.

Waste management practices in 27 petroleum rerefining plants which generate lubricants and fuels from waste oils are reviewed. The rerefining process utilizes pretreatment with heat and chemicals, distillation with bleaching clay, and post treatment with filtration and acid neutralization. Wastes generated by these processes include acid or caustic sludges and spent clay wastes. Sources of waste water include water in raw waste which settles during storage, groundwater runoff containing oil

from spills and leakage, process cooling water, and steam stripping water. The latter waste water is considered the most hazardous, containing lead, zinc, phenols, and hexane solubles. Treatment and disposal techniques practiced by the industry include the use of on-site or off-site landfills without treatment of wastes, landfilling with prior acid neutralization or fixative material treatment, or the use of chemically secure landfills with or without waste treatment. Projections for production of rerefined oil and production of wastes were made for 1977 and 1983. (Lisk-FRC)
W79-07781

FINAL REPORT ON FATE OF METALS APPLIED IN SEWAGE AT LAND WASTEWATER DISPOSAL SITES,
Texas A and M Research Foundation, College Station.
For primary bibliographic entry see Field 5B.
W79-07789

UTILIZATION OF SOIL INVERTEBRATES IN STABILIZATION, DECONTAMINATION, AND DETOXIFICATION OF RESIDUAL SLUDGES FROM TREATMENT OF WASTEWATER (INTERIM REPORT),
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. School of Biology, Chemistry and Ecology.
R. Hartenstein, and M. J. Mitchell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 141, Price codes: A07 in paper copy, A01 in microfiche. Report NSF/RA-770138, 1977. 133 p, 5 fig, 15 tab, 45 ref, 11 append.

Descriptors: *Sludge treatment, *Biological treatment, *Organic matter, *Worms, *Degradation, Odor, Toxicity, Salmonella, Nematodes, Stabilization.

The problem of reducing organic matter content in sludge without destroying the biological value of sludge to the soil ecosystem was reviewed. Earthworms may be used to convert a relatively infertile sludge into a fertile, organic topsoil. In combination with nematodes, bacteria, and other microorganisms, earthworms can deodorize soil, destroy salmonella, and reduce the unstable organic content of sludges. Research projects are reviewed on the following topics: sludge toxicity to earthworms, degradation and stabilization of sludge, modification of certain chemical properties of sludge, effect of soil macroinvertebrates on bacterial and nematode populations, and effect of earthworms on salmonella typhimurium. Reports of various studies constitute the bulk of this document. (Small-FRC)
W79-07802

SLUDGE INCINERATION SYSTEMS FOR PURIFICATION AND RESOURCE RECOVERY,
Envirotech Corp., Menlo Park, CA.
F. P. Sebastian.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 8-26, 1975. 10 fig, 8 ref.

Descriptors: *Sewage sludge, *Incineration, *Reclamation, *Polychlorinated biphenyls, *Drying, Oxidation, Heat treatment, Sludge disposal, Ultimate disposal, Waste water treatment, Sewage treatment, Sludge treatment, Municipal wastes.

The use of multiple hearth furnaces for the incineration or drying of various municipal sludges is discussed. Multiple hearth furnaces may also be used for burning or drying raw sludge, digested sludge, and sewage greases; recalcining lime sludge and waste pond sludge; reclaiming various industrial wastes; regenerating spent activated carbon and diatomaceous earth. The multiple hearth furnace is a refractory containing a series of hearths; in the upper hearths, the feed is dried to about 48% moisture, in the incineration/deodorization zone, the temperature is maintained at 760-982C, and in the cooling zone, hot ash contributes its heat to incoming combustion air. Tests for polychlorinated biphenyl (PCB) destruction in incinerated sludge indicated that at 371C, 95% PCB destruction was achieved at 0.1 sec exhaust gas detention time and at 593C, 99.9% destruction was achieved at the same detention time. The importance of PCB destruction is reviewed and the impacts of incineration on air quality are discussed. The incineration of certain sludges also permits the reclamation of lime and/or energy and the recovery of ash as a fertilizer. Costs associated with thermal oxidation of sludges are discussed. (See also W79-07825) (Lisk-FRC)
W79-07827

MANAGEMENT OF OIL SLUDGE FROM A REFINERY WASTE WATER TREATMENT PLANT,
Bashkirian Scientific Research Inst. of Petroleum Refining (USSR).
E. G. Ioakimis, and A. D. Davletov.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 27-35, 1975. 6 fig.

Descriptors: *Incineration, *Oil wastes, *Sludge treatment, *Oil industry, *Sludge disposal, Pilot plants, Industrial wastes.

Systems currently employed in the USSR for the incineration of oil sludge from refineries are described. Pilot plant studies of rotary drum kiln incinerators indicated that combustion is incomplete with about 28% of the non-combusted materials exhausted with the off-gases. Furnaces with bubble burners are considered simple and operate by separating water from the sludge prior to incineration in the kiln. These furnaces are capable of incinerating aged emulsions and oil sludges containing up to 5% solids and 35-40% petroleum products but lack ash-catching facilities. In fluid-bed incinerators, the sludge is pretreated and incinerated in a sand fluid bed of a vertical kiln where mechanic burners atomize fuel, oil sludge and cooling water. However, air temperatures of 600C for fluidization are required to provide normal operation of the incinerator with oil sludges and problems have been encountered attempting to improve the efficiency of the system. In an incinerator which was modified from a fluid bed to torch burning under the use of a rotary burner, the sludge intake and pretreatment, the sludge feed to the incinerator, and its atomizing, cooling off-gases were modernized. The modifications to the system permitted an average capacity of 2.7 tons/hr with a maximum capacity of 4 tons/hr when incinerating sludge containing 25-27% petroleum products and 5-10% solids. The flow diagram for the system is illustrated. (See also W79-07825) (Lisk-FRC)
W79-07828

MODERN STATE AND PRINCIPAL TRENDS IN TECHNOLOGY DEVELOPMENT FOR WASTEWATER SLUDGE TREATMENT,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
G. S. Altovsky.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 36-38, 1975.

Descriptors: *Sewage sludge, *Sludge treatment, *Dewatering, *Separation techniques, *Incineration, Anaerobic digestion, Sludge digestion, Flocculation, Heat treatment, Sludge disposal, Municipal wastes.

Municipal sludge treatment and disposal methodology is discussed and areas for improvement and research are identified. Common sludge treatment practices include gravity thickening, flotation, centrifugal separation, vibrothickening, stabilization by anaerobic or aerobic digestion, addition of reagents such as ferric chloride and lime, heat treatment, flocculation with high molecular polyelectrolytes, vacuum filtration, pressure filtration, centrifugal dewatering, vibrofiltration, and incineration. Improvements in sludge heat treatment systems required include: heat treatment for sludge conditioning prior to dewatering, heat drying of dewatered sludges for utilization in agriculture, and incineration of unutilized sludge to reduce the mass. Developments and improvements are also required for vibrothickening and dewatering equipment and plants, flocculation agents, and centrifugal separators. Agricultural and sanitary-hygienic evaluations of waste water sludges are also necessary. (See also W79-07825) (Lisk-FRC)
W79-07829

MANAGEMENT AND DISPOSAL OF RESIDUALS FROM TREATMENT OF INDUSTRIAL WASTEWATERS,
Environmental Protection Agency, Washington, DC. Industrial Pollution Control Div.
W. J. Lacy, and A. Cywin.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 39-52, 1975.

Descriptors: *Industrial wastes, *Waste treatment, *Waste disposal, *Waste water treatment, *Waste water disposal, Sludge treatment, Sludge disposal, Hazards.

A summation of eleven reports presented at the National Conference on Management and Disposal of Residues from the Treatment of Industrial Wastewaters is presented. The topics discussed by each speaker at the conference are summarized and the cover pages of the reports are reproduced. The speakers were affiliated with the U.S. Environmental Protection Agency and various industries and utilities. The various problems with and methods of treating and disposing of these wastes as discussed by the participants are summarized. (See also W79-07825) (Lisk-FRC)
W79-07830

INDUSTRIAL SLUDGE DISPOSL PRACTICES,
Environmental Protection Agency, Washington, DC. Industrial Pollution Control Div.
W. J. Lacy, and A. Cywin.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 53-62, 1975.

Descriptors: *Industrial wastes, *Chemical wastes, *Chemical industry, *Oil industry, *Food industry, Textiles, Dairy industry, Pulp and paper industry, Sludge treatment, Water reuse, Recycling, Tannery wastes, Waste water treatment, Waste water disposal.

The characteristics of various industrial wastes and costs and methods of treating and disposing of industrial sludges are summarized. The industrial sludges discussed are generated from the apple, citrus, and potato processing industries; building, construction, and paper industries; sugar beet processing; dairy product processing; flat glass production; grain processing; unbleached kraft and semi-chemical pulp industries; leather tanning and finishing processes; inorganic products industry; red meat processing; smelting and slag processing; steel production; synthetic resins industry; petroleum refining; phosphorus derived chemicals production; textile mills; tire and synthetics industry; and synthetic resins industries. Many of the treatment processes recover residual and reusable materials such as product fines, usable water, and thermal energy. (See also W79-07825) (Lisk-FRC)
W79-07831

THICKENING AND DEWATERING OF WASTE WATER SLUDGES BY VIBRO FILTRATION METHOD,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Gosstroi (USSR).
E. V. Dvinskih.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 63-67, 1975. 4 fig, 1 tab.

Descriptors: *Filtration, *Sludge treatment, *Separation techniques, *Mathematical models, *Screens, Vibrations, Dewatering, Filters, Activated sludge, Industrial wastes, Municipal wastes.

Mathematical models for the vibrofiltration of municipal and industrial sludges were developed to describe the thickening and dewatering processes. The study utilized a model of a continuous gravity vibrofilter with directed vibrations of the filtering media in the frequency range of 20-100 Hz and

cceleration of 10g. Metal screens as the filter nedia were found to be better than synthetic cloth ecause the cloth dissipated the vibrations. The rocess of sludge dewatering by vibrofiltration was ound to occur in two stages. In the first stage, a ayer of sludge with a higher solids content than ncoming sludge formed on the filtering screen and vas covered by a layer of sludge suspension conaining a solids content similar to that of the initial uspension. When this layer decreases to zero, the econd stage begins in initial suspension. When this ayer decreases to zero, the second stage begins in vhich the sludge layer decreases due to the separaion of filtrate. The solids concentration of the ludge layer constantly increases but the solids oncentration gradient on the layer depth is mainained at zero during the second stage of the filtraion process. Mathematical models of both process tages were developed. The vibrofiltration process vas tested for thickened activated sludge, primary ludge, digested coagulated sludge, a mixture of rimary and thickened activated sludge, sludge rom wood-fibered slab plants, and sludge from last furnace gas-cleaning process. (See also W79-7825) (Lisk-FRC)
V79-07832

MUNICIPAL SLUDGE MANAGEMENT RESEARCH PROGRAM IN THE U.S.A.,
National Environmental Research Center, Cincinati, OH. Advanced Waste Treatment Research ab.
. E. Smith, and W. A. Rosenkranz.
n: Handling, Treatment and Disposal of Vastewater Sludge, p 68-77, 1975. 17 ref.

Descriptors: *Sludge treatment, *Sludge disposal, Heat treatment, *Sludge digestion, *Chemical legradation, Landfills, Application methods, Filration, Dewatering, Incineration, Chemical vastes, Activated sludge, Waste water treatment, Municipal wastes.

Current and developing methods for the treatment nd disposal of municipal sludges are reviewed. Methods of treating and disposing of sludges in urrent practice include ocean dumping, pasteurzation, sterilization, heat treatment, wet oxidation, composting and heat drying, pyrolysis, and coinineration with solid wastes; some of these processs produce usable by-products. Land application echniques include liquid spreading, landfilling, nd trenching. The addition of alum, lime, ferric hloride, or polyelectrolytes during waste water reatment can upgrade treatment efficiencies. Vaste chemical sludge and waste activated sludge nay be treated with lime stabilization, autothermal hermophilic aerobic digestion, ash conditioning, hermal conditioning, top-feed rotary vacuum filration, moving belt filter presses, pressure filtraion, pyrolysis, and wet oxidation. (See also W79-7825) (Lisk-FRC)
V79-07833

NORGANIC SUSPENDED SLUDGE DEWATERING,
eningrad Civil Engineering Inst. (USSR).
. S. Lavrov, N. F. Feodorov, and V. N. Ponomareva.
n: Handling, Treatment and Disposal of Vastewater Sludge, p 78-80, 1975. 4 fig, 1 tab.

Descriptors: *Dewatering, *Sludge, *Flocculation, Coagulation, *Electric currents, Vacuum drying, Electrodes, Separation techniques, Suspension, Industrial wastes, Sludge treatment.

Parameters investigated during dewatering experiments with a flocculant sludge of metal hydroxides rom galvanic work and a concentrated silicateoxide sludge from refractory, ceramic, and abraive industries included: chemical composition of he solids and liquid phases, electrical conductivty, acidity, dispersion degree, stability, zeta-potenial, and the effects of the coagulants and flocculants. The refractory suspension was dosed with 40 nd 75 mg/liter aluminum sulfate or with 0.1-25 ng/liter polyacrylamide. Flocculants were found o be a suitable separation technique followed by compression in the hydroxide systems; a combinaion of coagulants and flocculants were considered more suitable for refractory suspensions. Electric field treatment with voltages in the range of 5-150 v/cm indicated that sludge compression was complete within 5 min of electrical treatment. Electric treatment of refractory sludges when 40-75 mg/liter of aluminum sulfate was injected permitted a reduction in voltage from 125 to 50 v/cm. The effect of electric treatment of sludges on the hydrodynamic specific resistance and efficiency of vacuum filtration of the sludges was also evaluated. (See also W79-07825) (Lisk-FRC)
W79-07834

DEWATERING OF SEWAGE SLUDGE BY MEANS OF CENTRIFUGES,
R. Ya. Agranonick.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 81-84, 1975. 2 tab, 3 ref.

Descriptors: *Centrifugation, *Sewage sludge, *Activated sludge, *Separation techniques, *Dewatering, Chemical degradation, Heat treatment, Sludge digestion, Waste water treatment, Sludge treatment, Municipal wastes.

Centrifuge dewatering was studied with raw or digested primary sludge, a mixture of digested primary and activated sludge, and raw activated sludge containing 28-35% or 38-42% ash. The solid-bowl scroll centrifuge had the advantages of compactness, elimination of the need for chemical additions, and production of transportable sludge with low moisture content. The dewatered sludge cakes had final moisture contents ranging from 65-80%. The centrifuge was also considered useful in low capacity plants with flows to 5,000 cu m. The large quantities of centrate produced by the centrifuge system may be utilized as return sludge, discharged to preliminary settling tanks, treated with combined aerobic and anaerobic digestion when originating from activated sludge mixture centrifugation, or dried in beds when originating from digested sludge. Chemical pretreatment and heat conditioning did improve the efficiency of the centrifuge but were not necessary. (See also W79-07825) (Lisk-FRC)
W79-07835

THERMAL DRYING OF DEWATERED SEWAGE SLUDGE,
L. L. Goldfarb.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 85-87, 1975.

Descriptors: *Sludge treatment, *Dewatering, *Drying, *Heat treatment, *Jets, Nozzles, Moisture content, Gases, Waste water treatment, Sludge disposal, Municipal wastes.

Methods of thermally drying mechanically dewatered sewage sludge were evaluated. Thermal drying of sludges reduces the volume and produces a disinfected, dry, loose, granulated or powdery material suitable as a fertilizer or fuel. Continuous convective dryers utilized in thermal drying of dewatered sludge include rotating, belt, loop, and pipedryers. However, these systems have high fuel consumption and certain operating or efficiency problems. A system of counterjet drying of mechanically dewatered sludge was found to be efficient and economical. In this system, sludge is fed into the dryer and 600-800C fuel gas is injected at 100-400 m/sec from a combuster through nozzles. The sludge is fed to the nozzle shears, comminuted with the hot gas, and passed to two oncoming jets where the streams collide, supplementary sludge disperses, and intensive drying occurs. Insufficiently dried sludge is returned to the dryer and gases are purified prior to discharge. The dried sludge has a moisture content of 30-45%. The dryers are compact, fully automated, simple to operate, and have significantly reduced capital and operating costs. (See also W79-07825) (Lisk-FRC)
W79-07836

AEROBIC STABILIZATION OF ACTIVATED SLUDGE,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidro-Geologii, Gosstroi (USSR).
A. V. Abramov.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 88-92, 1975. 4 fig.

Descriptors: *Mathematical models, *Stabilization, *Sludge treatment, *Aerobic treatment, *Equations, Analytical techniques, Activated sludge, Mathematical studies, Waste water treatment, Municipal wastes.

Mathematical models were developed to describe primary regularities of excess activated sludge aerobic stabilization. Equations are provided for calculating the degradation limit; the degradation value; the degradation rate; the oxygen uptake rate; the specific oxygen uptake; the required detention time for complete-mixing reactors, for plug-flow reactors, and for multi-cell reactors; gas release values for stabilized and inflowing sludges, and sludge age. Guidelines and recommendations for utilizing the equations are provided and the aerobic stabilization process and the interrelationships of certain factors in the equations are illustrated. (See also W79-07825) (Lisk-FRC)
W79-07837

UTILIZATION OF MUNICIPAL SLUDGE IN AGRICULTURE,
B. T. Lynam, C. Lue-Hing, R. R. Rimkus, and F. C. Neil.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 110-143, 1975. 10 fig, 17 tab, 37 ref.

Descriptors: *Ultimate disposal, *Agriculture, *Sewage sludge, *Application methods, *Land use, Irrigation systems, Costs, Public health, Monitoring, Crop response.

The utilization of municipal sludge in agriculture is reviewed as a means for the disposal of waste water solids in a technically feasible and socially acceptable manner. The properties of sewage sludge are discussed including plant nutrient levels. Sludge land application rates and their relationship to crop production and reclamation of spoils are discussed. Site selection, design, and management are considered with discussion of topography and soil factors, site preparation, site management, and public relations. Irrigation systems are discussed including soil incorporation and injection systems and Slurry, cake, and solids handling systems. Soil and crop responses to sludge application are explored, and environmental monitoring of the sludge application process is described including public health aspects. Costs of sludge application are presented for Fulton County, Illinois. (See also W79-07825) (Small-FRC)
W79-07840

PROCEEDINGS OF THE SEMINAR ON CURRENT APPROACHES IN WASTEWATER TREATMENT.
For primary bibliographic entry see Field 5D.
W79-07842

OPERATIONAL EXPERIENCE WITH THE ZIMPRO LOW-PRESSURE WET AIR OXIDATION PROCESS,
Gore and Storrie Ltd., Toronto (Ontario).
P. F. da Silva.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 37-45, 1978. 1 fig, 2 tab.

Descriptors: *Sewage sludge, *Dewatering, *Heat treatment, *Vacuum drying, *Oxidation, Filtration, Odor, Incineration, Steam, Sludge treatment, Sludge disposal, Municipal wastes.

Two 200 imperial gpm streams will be added to the Zimpro wet air oxidation units at the Lakeview Water Pollution Control Plant in Canada. The existing units have been operating for three years. Digested, gravity thickened waste activated and raw sludges are blended with propeller-type mixers in the blending tanks, macerated, and pressurized under aeration. The sludge mixture is then preheat-

ed prior to thermal conditioning in the reactor at 375 F. The sludge is thickened to about 10% solids and the supernatant and filtrate are returned to the inlet of the primary tanks. The sludge is then vacuum filtered to a cake with between 38-55% solids. Odor problems at the plant were partially eliminated by scrubbing discharge gases with a solution of potassium permanganate. Fluidized-bed incinerators are under construction to coincinerate odors and filter cake; this system is expected to generate sufficient steam for the thermal conditioning process. (See also W79-07842) (Lisk-FRC)
W79-07845

THE SAN FRANCISCO BAY DELTA WASTEWATER AND RESIDUAL SOLIDS MANAGEMENT STUDY. VOLUME VI. TECHNICAL APPENDIX. THE PUBLIC HEALTH IMPLICATIONS OF LAND APPLICATION OF WASTEWATER AND RESIDUAL SOLIDS,
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 891, Price codes: A04 in paper copy, A01 in microfiche. Report, 1973, 51 p, 5 fig, 6 tab, 2 append.

Descriptors: *Public health, *Wastewater disposal, *Forecasting, *Probability, *Land use, Application methods, Enteric bacteria, Diseases, Zoonoses, Toxicity, Wastewater treatment, Infection.

The public health aspects of wastewater disposal at eight sites is evaluated using the probability matrix technique. The eight sites considered for the disposal of wastewater generated by the 12 Bay Area counties were ranked in three groups. The groupings were based on the potential incidence of Coccidioidomycosis at two sites, and the potential for Zoonotic diseases of encephalitis and plague in all areas. The hazard of toxic and infectious agents can be controlled by wastewater treatment, but the control of Zoonotic disease is less certain. Pilot studies are recommended for representative areas. (Small-FRC)
W79-07869

DESTROYING CHEMICAL WASTES IN COMMERCIAL SCALE INCINERATORS. FACILITY REPORT NUMBER 3 - SYSTEMS TECHNOLOGY,
TRW Defense and Space Systems Group, Redondo Beach, CA.
For primary bibliographic entry see Field 5D.
W79-07871

DESTROYING CHEMICAL WASTES IN COMMERCIAL SCALE INCINERATORS. FACILITY REPORT NUMBER 1 - THE MARQUARDT COMPANY,
TRW Defense and Space Systems Group, Redondo Beach, CA.
For primary bibliographic entry see Field 5D.
W79-07872

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: STATE ANALYSES VOLUME II,
Wisconsin Univ.-Madison. School of Law.
For primary bibliographic entry see Field 6E.
W79-07876

IMPACT OF WASTEWATER TREATMENT PLANT DISCHARGES,
Maryland Univ., College Park. Inland Environmental Lab.
For primary bibliographic entry see Field 5C.
W79-07985

5F. Water Treatment and Quality Alteration

STRENGTH PROPERTIES OF LIQUID-BORNE FLOCCULATED MATTER,
Delaware Univ., Newark. Dept. of Civil Engineering.
J. E. Quigley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 423, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, June 1977. 100 p, 3 fig, 34 ref. OWRT A-036-DEL (1).

Descriptors: *Flocculation, *Aggregates, *Water treatment, Ferric hydroxide.

Breakup of liquid-borne aggregrates during flocculation induced by agitation is important in determining aggregate size distribution and solid/liquid separation process performance. This research attempts to define and measure properties of liquid-borne flocs which characterize resistance to disruption by fluid forces. Disruption of individual flocs (ferric hydroxide, ground activated carbon and calcium carbonate) was filmed in a plane hyperbolic flow field using a modified version of the four roller apparatus devised by G. I. Taylor. Resistance of ferric hydroxide sediment to disruption was affected by centrifugation time. Activated carbon exhibited very slight cohesion, and calcium carbonate was noncohesive. Ferric hydroxide flocs showed no visible resistance to disruption regardless of initial size. When centrifuged for twenty minutes they did not break up or erode. Flocs less than 1 cm broke into two roughly equal fragments; larger flocs broke into multiple smaller fragments. Disruption of only the ferric hydroxide flocs centrifuged ten minutes was effected by changes in roller rotation speed. Strain rates and axial stress are directly proportional and changes in roller speed affected both to the same degree.
W79-07578

REMOVING HYDROGEN SULFIDE WITH HYDROGEN PEROXIDE,
National Water Well Association, Wothington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 6, p 32-33, July, 1979. 1 fig, 1 tab.

Descriptors: *Hydrogen sulfide, *Water treatment, *Hydrogen peroxide, Water analysis, Laboratory tests, Color reactions, Aeration, Chlorination, Activated carbon, Filtration, Oxidation, Ozone, Aesthetics, Taste, Odor.

Drinking water with concentrations of hydrogen sulfide (H2S) as low as .05 to .1 mg/1 has a 'rotten egg' odor and taste and can cause corrosion and tarnishing of iron, copper and silver. Prolonged exposure to H2S leads to paralysis of the olfactory nerves in humans and weight loss, reduced milk production and reproductive complications in livestock. H2S concentrations in water can be measured using the acidizing test or the methylene blue test. The advantages and disadvantage of several methods for removal of H2S from water are tabulated. The use of hydrogen peroxide (H202) to remove H2S is described in detail. H202 breaks down H2S into elemental sulfur and water. If concentrations are high enough, elemental sulfur produced through oxidation may have to be removed with a carbon filter before water is acceptable for drinking or cooking purposes. The design of a hydrogen peroxide feed system is illustrated and explained. Hydrogen peroxide treatment of H2S avoids the high cost, corrosion, residual tastes and slow reaction times of other chemical treatment methods. (Purdin-NWWA)
W79-07762

REDUCTIONS IN WATER CONSUMPTION AND FLOW OF SEWAGE - REPORT TO CONGRESS.
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 681, Price codes: A03 in paper copy, A01 in microfiche. 1974. 39 p, 4 fig, 67 ref, 2 append.

Descriptors: *Discharge measurements, *Flow control, *Consumptive use, *Waste water disposal, *Treatment, Investigations, Infiltration, Water conservation, Sewage, Municipal wastes.

The results of the Environmental Protection Agency's investigation of methods of reducing waste water flows and the consumption of water are presented. The report includes an investigation of devices, systems, incentives, policies, and other techniques of reducing the total flow of sewage. This flow reduction analysis incorporated a study of unnecessary water consumption as related to the reduction of requirements for sewage and waste water treatment. The major flow reductions study areas included infiltration/inflow, domestic waste water, industrial waste water, and EPA programs involved with waste water flow reduction. The data identified potentials for reductions in water consumption and waste water flows. Reductions in waste water flows were also related to infiltration/inflow, user charges, waste water discharge standards, cost-effectiveness, facility planning, and effluent guidelines. (Lisk-FRC)
W79-07785

POLICY ON MUNICIPAL SLUDGES,
Environmental Protection Agency, Washington, DC. Municipal Construction Div.
B. L. Seabrook, and W. A. Whittington.
In: Handling, Treatment and Disposal of Wastewater Sludge, p 1-7, 1975. 4 tab.

Descriptors: *Sludge disposal, *Application methods, *Land use, *Incineration, *Landfills, Sewage sludge, Sludge treatment, Return flow, Sludge digestion, Waste water treatment, Municipal wastes.

The implementation of secondary treatment of municipal waste waters will increase the volume of sludge generated, necessitating evaluation of sludge disposal alternatives. Of the approximately 22,000 waste water treatment plants, 5,000 utilize treatment ponds where sludge is seldom extracted. In 1975, sludge was generated at an estimated rate of 17,000 dry tons/day; estimated levels in 1985, after implementation of secondary treatment, are 23,000 dry tons/day. Of the 1975 total, 25% is landfills, 15% is ocean dumped, 35% is incinerated, and 25% is applied to land. Land applications techniques include spreading of liquid digested sludge by tank truck, plow injection, or ridge and furrow spreading. Dried, dewatered sludge or composted, digested sludge may be applied to land or incorporated into the soil by plowing, discing, or other methods. Spray application of digested sludge is another alternative. Considerations in applying sludge to land include concentrations of total and inorganic nitrogen, phosphate, and potassium and requirements of the vegetation. Guidelines have been established for landfilling of sludge. Incineration of sludge is considered a volume reduction process and measures must be taken to limit polychlorinated biphenyl and other emissions from the incinerator. Ocean disposal of sludge is suitable only for those plants presently practicing this method; sludge must meet EPA criteria. (See also W79-07825) (Lisk-FRC)
W79-07826

HIGHLIGHTS OF THE CLEAN WATER ACT OF 1977,
For primary bibliographic entry see Field 5D.
W79-07874

A REVISION OF EXISTING REGULATIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07883

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

WATER QUALITY CONTROL AND BLOOMINGTON LAKE,
Corps of Engineers, Baltimore, MD. Baltimore District.

or primary bibliographic entry see Field 8A.
V79-07979

G. Water Quality Control

ESERVOIRS AND WATERWAYS; IDENTIFI-ATION AND ASSESSMENT OF ENVIRON-IENTAL QUALITY PROBLEMS AND RE-EARCH PROGRAM DEVELOPMENT,
rmy Engineer Waterways Experiment Station, icksburg, MS.
W. Keeley, J. L. Mahloch, J. W. Barko, D. unnison, and J. D. Westhoff.
vailable from the National Technical Information ervice, Springfield, VA 22161 as AD-A060 729, rice codes: A08 in paper copy, A01 in microfiche. echnical Report E-78-1, July 1978. 152 p, 25 fig, 5 tab, 94 ref.

escriptors: *Environmental effects, *Reservoirs, Channels, *Water quality, *Research.

resents results of an effort to identify and assess nvironmental quality problems associated with ivil Works activities of the Corps of Engineers CE) and a recommended research program to ddress these problems. Visits to all CE Division ffices and subsequent submission of written infor-ation from field offices revealed six key problem reas related to current practices and identified riority research needs. The ability to predict the nvironmental impact of operational alternatives or roposed projects is needed including hydrodyna-ic, chemical, and biological aspects. Operational roblems relative to fluctuating water levels, mini-um releases, and filling alternatives for reservoirs ave been documented, and research on this is equired. Flood control and navigation projects ithin waterways have environmental impacts at, for the most part, have not been documented r specifically related to CE activities in water-ays. Research is required to document those im-acts and provide technology for alleviating ad-erse impacts. Comprehensive techniques for ater resources management harmonious with en-ironmental quality objectives on a regional basis re inadequate or require verification. A research rogram to address the stated problems should nvolve applied research with extensive field stud-es to verify program results. A $30 million, six-ear research program has been proposed to ad-ress these problems. (WES)
V79-07522

ASPECTS OF STATE-WIDE EMERGENCY RE-PONSE PROGRAMS FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES PROGRAM,
Viley and Wilson, Inc., Lynchburg, VA.
vailable from the National Technical Information ervice, Springfield, VA 22161 as PB-279 551, rice codes: A04 in paper copy, A01 in microfiche. eport, 1974. 77 p, 5 fig, 131 ref, 3 append.

escriptors: *Municipal wastes, *Water pollution ources, *Regulation, *Overflow, Discharge(Water), Flow, Streams, State govern-ents, Federal government.

nformation is provided to assist in the develop-ent of state emergency programs for spills of raw r inadequately treated municipal wastewater. Ex-sting and proposed Federal statutes and current tate water pollution laws are reviewed. Over 55 tate and interstate agencies were asked to provide nformation on existing or future water pollution ontingency plans, and over 200 wastewater treat-ent facilities were asked to provide information n emergency plans. Few states were found to equire reporting of spills or had contingency plans pecific for municipal wastewater spills. Very few unicipal treatment systems had formal emergen-y response plans. It is recommended that states evelop regulations and emergency response plans o deal with possible spills. Flow models of critical treams should also be developed. Further, emer-ency equipment and personnel inventories are ecommended. (Small-FRC)
V79-07797

HIGHLIGHTS OF THE CLEAN WATER ACT OF 1977,
For primary bibliographic entry see Field 5D.
W79-07874

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: STATE ANALYSES VOLUME II,
Wisconsin Univ.-Madison. School of Law.
For primary bibliographic entry see Field 6E.
W79-07876

A REVISION OF EXISTING REGULATIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07883

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

GROUND AND SURFACE WATER IN NEW MEXICO: ARE THEY PROTECTED AGAINST URANIUM MINING AND MILLING,
For primary bibliographic entry see Field 6E.
W79-07896

HARBOR LINES AND THE PUBLIC TRUST DOCTRINE IN WASHINGTON NAVIGABLE WATERS,
Washington Univ., Seattle. School of Law.
For primary bibliographic entry see Field 4C.
W79-07897

ANALYSES OF 1975-76 MICROZOOPLANKTON SAMPLES FROM TRANSECT II,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
P. L. Johansen.
In: 'Environmental Studies, South Texas Outer Continental Shelf, Biology and Chemistry,' Texas University Marine Science Institute, Supplemental Reports to Contract AA550-CT6-17, to the Bureau of Land Management, p 2-1 - 2-44, 1979. 1 fig, 4 tab, 9 ref, 2 append. AA550-CT6-17.

Descriptors: *Texas, *Zooplankton, *Biomass, *Water quality, Monitoring, Protozoa, Temporal distribution, Spatial distribution, Water pollution effects, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, Petroleum development, Diversity index, Ciliated protozoa, Oligotrichs, Tintinnids, Foraminifera, Radiolaria, Acantharia, South Texas Outer Continental Shelf(STOCS).

Seventy-two (72) one liter samples were collected from the BLM-STOCS Transect II during 1975 and 1976. During November and December 1976, the protozoan biomass ranged from three to seventeen percent of the macrozooplankton biomass. Some qualitative information was obtained from the remaining data. Oligotrichs as a group were widespread in both time and space, while tintinnids, foraminifera, radiolaria/acantharia and other protozoa tended to be more restricted in both temporal and spatial distribution. It is possible that marine protozoa may serve as both short and long term indicators of water quality and should therefore be monitored at regular intervals. (Sinha-OEIS)
W79-07916

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

FUTURE RESEARCH NEEDS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr.
In: The Freshwater Potomac: Aquatic Communities and Environmental Stresses, p 102-105, 1978. 14 ref. Flynn, K. C., and Mason, W. T., Eds., Interstate Commission on the Potomac River Basin.

Descriptors: *Research and development, *River basin development, *Environmental effects, Modeling, Forecasting, Technology, Methodology, Decision making, Legislation, Manpower, Scientific personnel, Professional personnel, Ecosystems, Protection.

Areas in which research would benefit future studies of the Potomac and other basins are discussed. More programs for professional certification need to be developed to assure professional competency of those engaged in solving environmental problems. The present state-of-the-art for environmental impact statements and other documents proportedly describing the effects of a proposed course of action requires improved methodology in the form of predictive modeling. Existing technology developed for biological monitoring of an ecosystem should be transferred to the industrial and other user groups. Standardizing the methods for the biological assessment of pollution is important, so that the most reliable methods will be used by regulatory agencies and as evidence for major environmental decisions. When environmental legislation was drafted the number of trained personnel and the specialized types of training required were not given the consideration necessary for the successful implementation of these programs. The provision of better man-power estimates with each new price of legislation is suggested. A willingness to recognize collective effort in research would make more data available to users. (Davison-IPA)
W79-07517

A WATER RESOURCE PLANNING PROCEDURE FOR RURAL TOWNS,
Vermont Univ. Burlington, Research Economics.
F. O. Sargent, P. R. Berke, and E. B. Henson.
Water Resources Bulletin, Vol. 15, No. 2, p 496-505, April 1979. 5 tab, 5 ref. OWRT A-019-VT (3).

Descriptors: *Water resources, *Planning, *Lakes, *Watersheds(Basins), *Rural towns, Management, Land use, Water quality, Lake shores, Development potential, Economic value, Carrying capacity, Vulnerability, Intensity index.

Six new techniques have been developed for lake watershed analysis and water resource management. The techniques are for determining: (1) watershed land use intensity with reference to water quality; (2) lake vulnerability; (3) water quality; (4) watershed carrying capacity; (5) the economic value of the lake; and (6) the potential of undeveloped lakeshore. These analyses are designed for use by rural planning commissions with guidance and assistance from state agencies and the state university. The comprehensive rural watershed land and water use plan developed by this procedure is inexpensive in time and money, understandable by the layman, and scientifically sound. It is based on presently available information. This water resource planning procedure has been demonstrated in several town planning projects. It is suggested that this method, or modification of it, could be adopted in all rural states by a few administrators and without any new enabling or appropriations legislation. (Bell Graf-Cornell)
W79-07561

Group 6A—Techniques Of Planning

A RESERVOIR OPERATING MODEL WITH INORGANIC QUALITY CONSTRAINTS FOR THE TRUCKEE RIVER,
Boyle Engineering Corp., Las Vegas, NV.; and Nevada Univ. System, Las Vegas Desert Research Inst.
For primary bibliographic entry see Field 4A.
W79-07562

ON-LAND DISPOSAL OF MUNICIPAL SEWAGE SLUDGE: A GUIDE TO PROJECT DEVELOPMENT (INTERIM REPORT),
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5E.
W79-07780

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
D. W. Jensen, E. Hoban, G. Horak, M. Lewis, and R. L. Dewsnup.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 046, Price codes: A05 in paper copy, A01 in microfiche. Report FWS/OBS-77/29, Oct 1977, 63 p.

Descriptors: *Stream flow, *Stream improvement, *Water rights, *Water policy, Flow, Flow system, Stream flow forecasting, Fish conservation, Wildlife, Wildlife conservation, Water supply, Appropriation.

The appropriation doctrine is the principal system by which western states allocate the water use. The most promising strategies (methods) for reserving instream flows for fish and wildlife under existing laws are identified, described and evaluated. Twenty-six strategies are discussed including: (1) obtaining an appropriation from state water rights agency; (2) condemning and reallocating existing rights; (3) encouraging the state water permit authority to take advantage of discretionary opportunities; (4) obtaining a moratorium on new appropriations and further stream depletions; (5) enhancing stream flows through contractual arrangements, (6) adopting interagency agreements, regulations, and formal procedures; (7) identifying instream flow requirements of endangered species; (8) including streams within a Wild and Scenic Rivers system; (9) legislatively designating important fishery streams; (10) utilizing water-quality laws; (11) obtaining reservoir space, (12) including stipulations in new and renewed licenses and permits; (13) reauthorizing existing projects; (14) utilizing public trust doctrine; (15) participating in statewide water planning; (16) utilizing federal funding programs; (17) conveying stored water to downstream/users; (18) constructing larger new reservoirs; (19) coordinating operation of multi-reservoir systems and (20) releasing from reservoir sediment storage reserves. (Fortin-Florida)
W79-07878

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NON-POINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

WATER RIGHT LAWS AS THEY AFFECT LAND ACQUISITION AND CONSTRUCTION,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
For primary bibliographic entry see Field 4A.
W79-07891

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07893

PROTECTING MASSACHUSETTS WETLANDS,
Suffolk Univ., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-07908

CHATTAHOOCHEE RIVER THERMAL ALTERATIONS,
Geological Survey, NSTL Station, MS. Water Resources Div. and Geological Survey, Doraville, GA. Water Resources Div.
H. E. Jobson, L. F. Land, and R. E. Faye.
ASCE Proceedings, Journal of the Hydraulics Division, Vol. 105, No. HY4, Paper 14499, p 295-311, April 1979. 10 fig, 8 ref.

Descriptors: *Thermal pollution, *Streamflow, *Model studies, *Forecasting, *Water temperature, Powerplants, Cooling water, Mathematical models, Computer models, Heat transfer, Heat balance, Analytical techniques, Georgia, *Chattahoochee River(Ga).

A coupled flow-temperature model, developed previously for use with highly unsteady flow, was applied to a 43.12-mile reach of the Chattachoochee River starting in the urbanized section of Atlanta, Ga. The thermal regime of the modeled reach is modified by upstream reservoirs and includes the cooling-water discharge from the Atkinson and McDonough Power Plants which increases the river temperature by as much as 8.4 C. A linear, implicit finite-difference flow model was calibrated by use of a depth profile obtained at steady low flow as well as unsteady flow data obtained in July 1976. The flow model was verified by use of dynamic stage and discharge data obtained in August 1976. The water temperature changed as much as 4.4 C while passing through a 17-mile part of the reach and the temperature model was capable of predicting these changes with a root-mean-square error of 0.72 C in July and 0.65 C in August 1976. (Woodard-USGS)
W79-07936

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN DELAWARE,
Geological Survey, Towson, MD. Water Resources Div.
R. H. Simmons, and D. H. Carpenter.
Geological Survey Water-Resources Investigations 78-93 (open-file report), September 1978. 69 p, 3 fig, 3 plates, 5 tab, 15 ref.

Descriptors: *Delaware, *Flood forecasting, Flood recurrence interval, *Flood peak, *Regression analysis, Streamflow, Peak discharge, Natural streams, Watersheds(Basins), Analytical techniques, Flood frequency, Gaging stations, Model studies, Rainfall-runoff relationships, Equations, Evaluation, Ungaged streams, Basin characteristics.

A flood-estimating method is presented which applies to drainage basins in Delaware without urban development and covers selected recurrence intervals from 2 to 100 years. The method was developed by multiple-regression techniques. The State is divided into two regions and sets of equations for calculating peak discharges based on physical basin characteristics are provided for each region. The boundary between regions generally corresponds with the division between the Piedmont and Coastal Plain provinces. In the northern region, flood-peak discharges were related to basin drainage area and storage. In the southern region, flood peaks were related to drainage area, slope, storage, forest cover, and two composite soil categories. Standard errors of estimate for the regression equations in the northern region ranged from 30 to 39 percent. For the southern region, the standard errors of estimate varied from 38 to 40 percent. Without using the two soil parameters in the southern region, the standard errors of estimate varied from 57 to 70 percent. Annual flood peaks, basin characteristics, and flood-frequency distributions are tabulated for the 60-gaged sites used in the regression analysis. At 23 of these sites, a rainfall-runoff model generated additional flood-peak data which were used in defining the flood-frequency distributions. (Woodard-USGS)
W79-07942

THE USE OF A SIMPLE MODEL AND UNCERTAINTY ANALYSIS IN LAKE MANAGEMENT,
Michigan State Univ., East Lansing. Dept. of Resources Development.
K. Reckhow.
Water Resources Bulletin, Vol. 15, No. 3, p 601-611, June 1979. 3 fig, 3 tab, 8 ref.

Descriptors: *Uncertainty, *Lakes, *Management, *Water quality, *Mathematical models, Phosphorus, Nonlinear regression analysis, Estimating, Confidence limits, Prediction, Nutrient budget, Sampling design, Data analysis, New Hampshire, Equations, Systems analysis.

A simple, black-box lake model was developed for phosphorus, using nonlinear regression analysis on a data base of north temperate lakes. The uncertainty associated with the model was then combined with the parameter uncertainty and the independent variable uncertainty to provide an estimate of the confidence limits associated with a predicted value. The prediction uncertainty is often neglected, yet it is an important measure of the usefulness of a model. Prediction uncertainty reflects the modeler's confidence in the model, and it should be used by a decision maker as a weight indicating the value of the model prediction. A procedure is outlined that combines lake modeling and uncertainty analysis for use in lake quality assessment and lake management. An example is provided illustrating the use of this procedure in nutrient budget sampling design, data analysis, and the evaluation of lake management strategies for a 208 program in New Hampshire. (Bell-Graf--Cornell)
W79-07996

ANALYSIS OF CLOSED CONDUIT IRRIGATION SYSTEM AND ITS SUBDIVISION,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. Karmeli, and G. Oron.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR2, p 187-196, June 1979. 2 fig, 1 tab, 15 ref.

Descriptors: *Irrigation systems, *Closed conduits, *Mixed integer programming, *Nonlinear programming, *Cost minimization, Optimization, Subdivisions, Constraints, Mathematical models, Equations, Systems analysis, Pipes, Objective function, Methodology, Water distribution(Applied).

An analysis of closed conduit irrigation systems towards minimal system cost is presented, using a nonlinear mixed integer programming optimization procedure. Emphasis is on the subdivision of the system into subunits and the relationship between the subunits, design parameters and system cost. The variables defined in the objective function and constraints are the number of manifold and lateral outlets, sizes of mains, submains, supplies, manifolds and laterals. An application example is given in which the subdivision for an irrigation system of a specific field is analyzed. (Bell Graf-Cornell)
W79-08000

6B. Evaluation Process

LEVELS OF ANALYSIS IN COMPREHENSIVE RIVER BASIN PLANNING,
Utah Water Research Lab., Logan.
D. T. Larson, L. D. James, and K. R. Kimball.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 273, Price codes: A06 in paper copy, A01 in microfiche. Utah Water Resources Planning Series, UWRL/P-79/05, May 1979. 110 p, 7 fig, 10 tab, 2 append. OWRT C-7161 (No. 6212) (1), 14-34-0001-6212.

escriptors: *River basin, *Planning, Decision aking, Political aspects, Social values, Colorado ver Basin, Uintah Basin.

nce every water resources management choice s two or more sides, differences must be re-lved. Equitable resolution requires understanding e reasons for the differences. The differences are tween decisions made by individuals and groups pacted in physical-environmental, economic, cial, cultural, and political dimensions and at vels ranging from local to international. The cisions generate additional impacts; and the in-ractive process changes water management prac-e in ways outside the control of any one decision int. The objective of this study is to conceptual-e this process in a way that will help establish stitutional mechanisms for reconciling differ-ces among levels of analysis. The conceptualiza-n views differences in the choices being made at rious levels of analysis as associated with per-ective differences having value, jurisdiction, tion and temporal elements. The history of water sources planning in the Colorado River Basin d a computerized simulation of water planning r the Uintah Basin are used to identify and ovide background for analyzing 20 major obsta-es to effective water resources planning. The rinciples of logic as applicable to rationality in cision making are used to identify two root uses of levels' conflicts. These are that the conse-ences of individual actions do not sum to the nsequences of an entire program and that indi-dual values do not aggregate linearly in forming cial values. Consequently many actions are not ficient in achieving preferred values, and deci-n makers are not able to implement desired ans. Nine recommendations are made on how to prove water resources planning in an interac-ve, nonlinear world.
79-07577

ATER-BASED ACTIVITY INVOLVEMENT OR RECREATION CONSUMERS AT STATE, EDERAL, LOCAL, OR PRIVATE FACILITIES,
urdue Univ., Lafayette, IN. Dept. of Forestry d Natural Resources.
T. O'Leary, and G. Pate.
Vater Resources Bulletin Vol. 15, No. 1. p 182-8, February 1979. 3 tab, 16 ref. OWRT A-051-ND (2).

escriptors: *Water sports, *Recreation, Social as-ects, Economics, Fishing, Hunting, Camping, wimming, Water skiing, Boating.

he water-based activity involvement of partici-nts at state and federal and local and private cilities identified by using participation rate roups is examined. No differences between par-cipant groups within activities based on socio-conomic characteristics were found. However, roups of highly active individuals were identified both types of properties. It is suggested that cial action system variables be added to tradi-onal social aggregate variables to assist the under-anding of leisure involvement.
79-07580

ATER IN THE WEST,
eological Survey, Reston, VA. Water Resources iv.
. E. Ferguson.
eotimes, p 27-29, March 1979.

escriptors: *History, *Water resources develop-ent, *Data collections, Federal government, ooperatives, Cost sharing, Reviews, *US Geo-gical Survey, *Water resources division.

lthough water-resources investigation has been ne of the major activities of the U.S. Geological urvey for many decades, water as a resource eceived no direct attention in 4 early surveys of he West, and the term 'water' cannot even be ound in the act of Congress of March 3, 1879, hich established the Survey. Several major rivers f the West had been surveyed but only because ey were barriers in East-West transportation cor-dors. However, in 1888--9 years after its estab-shment--the Survey brought together 14 carefully chosen men led by Frederick H. Newell, at a camp near Embudo, N. Mex., to select and provide train-ing in methods, instruments, and equipment needed for systematic stream gaging. A Senate resolution of that year, directing the Survey to investigate the practicality of storing water in the arid regions, required a knowledge of streamflow. Although others had collected various types of records of stream discharge at various places in the United States and in foreign countries, the Survey devel-oped techniques and standards that were widely accepted, and its stream-gaging network grew steadily, both in size and in geographic coverage. Today the Survey's Chief Hydrologist, Joseph S. Cragwall, Jr., directs an organization of about 4,100 full- and part-time employees, located in 46 district offices administered by 4 regional head-quarters. Congressional appropriations fund slight-ly more than half the water-resources programs, about 580 State and municipal agencies fund more than a quarter, and 27 other Federal agencies pro-vide money for the rest. (Woodard-USGS)
W79-07696

ENERGY DEVELOPMENT SCENARIOS AND WATER DEMANDS AND SUPPLIES--AN OVERVIEW,
Geological Survey, Reston, VA. Water Resources Div.
F. A. Kilpatrick.
Geological Survey open-file report 77-697, August 1977. 14 p, 10 fig, 3 tab, 16 ref.

Descriptors: *Water demand, *Available water, *Mining, *Energy, *Central U.S., Coal mines, Oil shales, Transportation, Slurries, Pipelines, Evalua-tion, Missouri River, Colorado River basin, *Energy development.

On the basis of average mean annual flows, ample water exists in the upper Missouri River basin for energy development. The lack of storage and di-version works upstream as well as State compacts preclude the ready use of this surplus water. These surplus flows are impounded in mainstream reser-voirs on the Missouri downstream from coal mining areas but could be transported back at some expense for use in Wyoming and North Dakota. There are limited water supplies available for the development of coal and oil shale industries in the upper Colorado River Basin. Fortunately oil shale mining, retorting and reclamation do not require as much water as coal conversion; in-situ oil shale retorting would seem to be particularly desirable in the light of reduced water consumption. Existing patterns of energy production, transport, and con-version suggest that more of the coal to be mined out West is apt to be transmitted to existing load centers rather than converted to electricity or gas in the water-short West. Scenarios of development of the West's fossil fuels may be overestimating the need for water since they have assumed that major conversion industries would develop in the West. Transport of coal to existing users will require all means of coal movement including unit trains, barges, and coal slurry pipelines. The latter is considered more desirable than the development of conversion industries in the West when overall water consumption is considered. (Woodard-USGS)
W79-07700

PLANS FOR WATER DATA ACQUISITION BY FEDERAL AGENCIES THROUGH FISCAL YEAR 1980,
Geological Survey, Reston, VA. Water Resources Div.
Geological Survey Office of Water Data Coordi-nation report, January 1979. 78 p, 2 append.

Descriptors: *Data collections, *Programs, *Fed-eral government, *Water resources development, Water supply, Water quality, Water utilization, Water pollution control, Land use, Urbanization, Flood control, Available water, Surface waters, Groundwater, Department of Agriculture, Depart-ment of Commerce, Department of Defense, De-partment of Energy, Department of Housing and Urban Development, Department of Interior, De-partment of Transportation, Council on Environ-mental Quality, Environmental Protection Agency, International Boundary and Water Com-mission, International Joint Commission, Nuclear Regulatory Commission, Tennessee Valley Au-thority, Water Resources Council.

This report was prepared by the Office of Water Data Coordination (OWDC), U.S. Geological Survey, in partial response to requirements of Bureau of the Budget (now Office of Management and Budget (OMB)) Circular A-67 (appendix A), which sets forth guidelines for the coordination of certain water-data acquisition activities by Federal agencies. The report was prepared in lieu of the customary annual 'Federal Plan for the Acquisition of Water Data.' Included are statements on Feder-al agencies' current water-data programs, plans and needs for water data through fiscal year (FY) 1980, and longer range water-data needs. The agency program summaries generally indicate that for FY 1980 most Federal programs for water-data collection will remain at approximately the same level of funding as for FY 1978 and 1979. Fore-most among agencies' current needs are additional data on water quality, water use, and surface-water resources. (Woodard-USGS)
W79-07704

VOLUME III. THE WETLANDS/EDGES PRO-GRAM. RESEARCH ON THE CHESAPEAKE BAY TO PROVIDE A KNOWLEDGE BASE FOR PHYSICAL ALTERATIONS OF THE EDGES OF THE CHESAPEAKE BAY,
Chesapeake Research Consortium, Inc., Baltimore, MD.
For primary bibliographic entry see Field 6G.
W79-07724

NATURAL RESOURCES OF COASTAL WET-LANDS IN NORTHERN SANTA BARBARA COUNTY,
San Diego State Univ., CA. Center for Regional Environmental Studies.
For primary bibliographic entry see Field 2L.
W79-07728

DEVELOPER'S HANDBOOK,
Connecticut Dept. of Environmental Protection, Hartford. Coastal Area Management Program.
A. Carroll.
1972. 60 p.

Descriptors: *Permits, *Regulation, *Wetlands, *Quality control, Dredging, Burning, Air pollu-tion, Water pollution, Planning, Septic tanks, Water supply, Road design, Construction, Lands-caping, Aesthetics.

The handbook is designed to help make the legal requirements for permits for environmental change more manageable to developers and to provide some basic information and advice on subdivision planning. The major natural systems and resources are briefly explained, and the opportunities and limitations they impose on development are sum-marized. A system of evaluating the characteristics of potential development sites is outlined and regu-latory programs at the Connecticut Department of Environmental Protection with which developers may have to concern themselves are covered. (Bol-linger-Mass)
W79-07735

ANALYSIS OF ECONOMIC EFFECTS OF WATER SURFACE ELEVATIONS ON U.S. SHORELINE OF LAKE CHAMPLAIN, NEW YORK AND VERMONT,
URS/Madigan-Praeger, Inc., New York.
Prepared for the International Joint Commission, International Champlain-Richelieu Board, August 31, 1977. 215 p.

Descriptors: *Lake Champlain, *Water level fluc-tuations, *Reservoir management, *Estimated benefits, Wetlands, Marsh plants, Water levels, Marsh management, Economic impact, Evalua-tion, Economic prediction, Flood damage, Dam-ages.

The objective was to develop the net benefits of the proposed regulation of the lake level by the use

of three proposed structural alternatives. The net benefits are obtained by subtracting the estimated damages with structual regulation from the estimated damages with regulation; the difference is considered to be the benefits of the scheme under consideration. Physical damages realized due to the high water condition would include costs for those structures with which the flood waters came into direct contact, i.e., homes, roads, furnishings. Non-physical damages would include costs for inconvenience due to flood occurrence, i.e., time lost, clean-up costs, wages lost from work. Adverse effects associated with extreme low-water conditions include exposed water supply intakes, loss of boat dock use, and exposure of unsightly lake bottom. The present wetland ecosystem, however, is dependent upon fluctuating water levels with periodic highs and lows. High waters flood out some of the emergents which sometimes form too dense or solid stands. It is particularly useful in the natural control of cattails and buttonbush. (Steiner-Mass)
W79-07744

FIRST ORDER ESTIMATES OF ENERGY REQUIREMENTS FOR POLLUTION CONTROL,
Development Sciences, Inc., Sagamore, MA.
J. L. Barker, K. Maddox, J. D. Westfield, and D. Wilcock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 274, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/7-78-022, 1978. 88 p, 4 fig, 31 tab, 66 ref, 2 append.

Descriptors: *Cost analysis, *Pollution abatement, *Water pollution control, *Air pollution, *Thermal pollution, Industrial wastes, Energy, Municipal wastes, Powerplants, Fuels, Operating costs, Operation and maintenance, Waste water treatment.

A cost analysis of the pollution controls required for stationary point sources included a cost estimation of controls for water pollution from powerplants, factories, refineries, municipal waste water treatment plants, and certain air pollution sources. Results of the study indicated that in 1977, a total of 1,553 trillion Btu of energy was required to control both water and air pollution from industrial and municipal sources. In 1983, a total of 3,075 trillion Btu is estimated for pollution abatement. The sources of these energy requirements include: energy for operation of control devices such as fans, pumps, and reheaters; the additional fuel requirement for processes where pollution abatement techniques degrade the efficiency of the process; the energy required for the production, transport, and installation of the pollution control equipment; and the energy expended in producing and transporting pollution control material such as limestone and chlorine. About 80% of the total energy requirements may be attributed to the direct utilization of fuel or electricity to operate pollution control equipment. The largest energy demands are required for control of industrial air pollution sources, followed by the energy requirements for controlling industrial water pollution. The third highest demand is the abatement of air pollution from powerplants. The report does not incorporate pollution controls for mobile pollution sources and non-point sources. (Lisk-FRC)
W79-07798

GUIDANCE ECONOMIC ANALYSIS FOR THE CONCRETE PRODUCTS INDUSTRIES.
Environmental Protection Agency, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 471, Price codes: A05 in paper copy, A01 in microfiche. Report EPA 440/2-77-016, 1977. 90 p, 54 tab.

Descriptors: *Economic impact, *Federal Water Pollution Control Act, *Industrial water, *Waste water treatment, *Concrete technology, Capital costs, Operating costs, Prices, Employment.

The economic impact of the application of alternative effluent limitation guidelines and standards of performance to be established by sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended, was analyzed for the concrete products industry. Existing and potential wastewater treatment control methods are surveyed. Investment and operating costs associated with various alternative control and treatment technologies are presented. Also, the broader economic effects of alternative approaches are examined. The effects on product price, unemployment and the continued viability of affected plants, and competitive effects such as the effect on foreign trade, are investigated. (Small-FRC)
W79-07803

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

THE ECONOMIC IMPACT OF ALTERNATIVE CYANIDE STANDARDS IN ILLINOIS,
IIT Research Inst., Chicago, IL.
For primary bibliographic entry see Field 6E.
W79-07885

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NON-POINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

EXPANDED OFFSHORE LEASING AND THE MANDATES OF NEPA,
For primary bibliographic entry see Field 5B.
W79-07898

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

RECENT CONGRESSIONAL ACTION ON OUTER CONTINENTAL SHELF OIL AND GAS DEVELOPMENT,
For primary bibliographic entry see Field 6E.
W79-07906

OPTIMUM ALTERNATIVES FOR CONTROLLING COMBINED SEWAGE OVERFLOWS--A CASE STUDY,
Barr Engineering Co., Minneapolis, MN.
I. Yomtovian.
Water Resources Bulletin, Vol. 15, No. 3, p 628-643, June 1979. 5 fig, 2 tab, 6 ref.

Descriptors: *Sewage systems, *Sewage overflow, *Methodology, *Effects, *Water quality, *Economic efficiency, *Combined sewers, Mississippi River, Optimization, Storm sewers, Water pollution control, Waste water disposal, Treatment facilities, Hydrology, Bypasses, Cost effectiveness.

Frequent high quantity overflows of combined sewage entering the Mississippi River near the city of Red Wing, Minnesota, have degraded water quality and caused concern among federal and state environmental agencies. The city of Red Wing was required to conduct a comprehensive waste control study, as part of the sewer system Construction Grant (Section 201 of PL 92-500), to identify alternative waste control and treatment measures and to recommend the optimum combination of alternatives in terms of both cost and waste control effectiveness. The study involved these basic steps: determination of present and future (year 2020) sanitary flow rates and volumes, storm runoff discharges, frequencies and volumes, and combined sewage bypass volumes; identification of alternative waste control measures; elimination of unfeasible alternatives; detailed analysis of the hydrologic, economic, and waste control feasibility of the promising alternatives; selection of the optimum combination of alternative waste control measures to satisfy the study objectives, and determination of construction priorities of the optimum control measures. Because of an uncertain budget and undetermined conditions of state and federal assistance, the city has not yet selected the optimum waste control measure for its needs. When the decision-making process between representatives of the city and the state commences, the optimum combination of waste control alternatives can be easily identified using results of this study. (Bell Graf-Cornell)
W79-07997

COST ANALYSIS OF WATER AND WASTE WATER TREATMENT PROCESSES IN DEVELOPING COUNTRIES,
Universidade Federal da Paraiba (Brazil).
M. I. Muiga, and G. W. Reid.
Water Resources Bulletin, Vol. 15, No. 3, p 838-852, June 1979. 1 fig, 5 tab, 17 ref.

Descriptors: *Water treatment, *Waste water treatment, *Cost analysis, *Predictive equations, *Regional models, *Planning, *Developing countries, Socio-economic indicators, Environment, Technology, Africa, Asia, Latin America, Construction costs, Operation and maintenance, Sand filters, Stabilization lagoon, Aerated lagoons, Activated sludge, Trickling filters, Water quality, Design capacity, Population, Systems analysis.

Mathematical modeling techniques have been used to develop predictive equations for the cost of water and waste water treatment processes in developing countries utilizing socio-economic, environmental, and technological indicators. Predictive equations were developed for each of the three regions (Africa, Asia, and Latin America) for construction, operation and maintenance costs of slow sand filter, rapid sand filter, stablization lagoon, aerated lagoon, activated sludge, and trickling filter. Data analysis indicated that cost of water treatment processes is a function of technological indicator (percentage of imported materials), population, and the design capacity. The variables which gave the best correlation for waste water treatment cost were population, design flow, and the percentage of imported waste water disposal materials. (Bell-Graf--Cornell)
W79-07999

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ASSESSMENT OF CIVIL MONETARY PENALTIES FOR WATER POLLUTION: A PROPOSAL FOR SHIFTING THE BURDEN OF PROOF REGARDING DAMAGES,
For primary bibliographic entry see Field 6E.
W79-07907

PROTECTING MASSACHUSETTS WETLANDS,
Suffolk Univ., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-07908

6D. Water Demand

WATER REUSE AND RECYCLING, VOLUME I: EVALUATION OF NEEDS AND POTENTIAL,
Culp/Wesner/Culp, Santa Ana, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 283, Price codes: A09 in paper copy, A01 in microfiche. Office of Water Research and Technology Report No. OWRT/RU-79-1, April 1979. 194 p, 22 fig, 37 tab, 67 ref. OWRT R-0088 (No. 7804) (1).

Descriptors: *Water reuse, *Recycling, *Hydrologic data, *Water quality, *Water quality control, *Water requirements, *Planning, Industrial water,

Agriculture, Regions, Irrigation, Cooling, Water supply, Water supply development.

Estimates of the potential for waste water reuse and recycling in the United States in 1985 and 2000 are presented. Information developed by the U.S. Water Resources Council (WRC) for the Second National Water Assessment was used to supply the basic data for water supply, water needs and availability, and waste water discharges. Recycling estimates derived from studies by the WRC, the Department of Commerce, the Bureau of Mines, and the Federal Power Commission (now the Federal Energy Regulatory Commission in the Department of Energy), are presented for industries and steam electric plants. Existing and proposed waste water reuse facilities are reported for each WRC Region. Water quality requirements are described for the following potential reusers of reclaimed waste water: agricultural irrigation, landscape irrigation, steam electric cooling, industrial cooling, and other industrial uses. Altough the Nation's water supplies are generally sufficient to meet the requirements for all beneficial purposes, there are major water supply problems in most of the 21 regions and severe local problems in many of the 106 subregions. Waste water discharges available for reuse and withdrawals capable of waste water reuse are tabulated for each of the 21 WRC Regions for 1975, 1985 and 2000. Regional evaluations for Lower Colorado and California are included. (Davison-IPA)
W79-07501

ENERGY DEVELOPMENT SCENARIOS AND WATER DEMANDS AND SUPPLIES--AN OVERVIEW,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6B.
W79-07700

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1976 -- NOVEMBER 30, 1977,
Geological Survey, Reston, VA. Water Resources Div. and Geological Survey, Milford, PA. Water Resources Div.
F. T. Schaefer, and R. E. Fish.
Geological Survey Delaware River Master report, 1978. 105 p, 6 fig, 2 plates, 20 tab, append.

Descriptors: *Delaware River, *Watershed management, *Available water, *Water delivery, *Water quality, Reservoir storage, Reservoir releases, Estuaries, Saline water intrusion, Monitoring, *Delaware River Master, Annual report.

This annual report of the River Master of the Delaware River is for the year December 1, 1976, to November 30, 1977. In terms of water supply, the year was above normal. The discharge of the Delaware River at Montague, New Jersey, adjusted for diversions and changes in reservoir storage, was 28 percent above median and the ninth highest since 1940. Total combined storage in Pepacton, Cannonsville, and Neversink Reservoirs was 87.9 percent of capacity on December 1, 1976, as compared with 95.9 percent a year earlier. This was the third highest total storage at the beginning of any report year since the construction of the reservoirs. Diversions for water supply for New York City and releases to maintain the flow of the Delaware River at Montague were made under the supervision of the River Master, as provided in the terms of the Amended Decree of the Supreme Court, June 7, 1954. Diversions through the Delaware & Raritan Canal in New Jersey did not exceed the limits imposed in the Decree. Data from the water-quality monitoring program carried out by the U.S. Geological Survey in the Delaware River Estuary are included. (Woodard-USGS)
W79-07702

HYDROLOGY,
Geological Survey, Reston, VA. Water Resources Div.
J. E. Moore.
In: Encyclopedia Britannica Yearbook of Science and Future, Earth Sciences, p 316-317, 1979.

Descriptors: *Hydrology, *Conferences, *Water quality, *Water supply, Surface waters, Groundwater, Water pollution, Waste disposal, Floods, Flood damage, Flood plains, Water policy, Water conservation, Sewage treatment, Symposia topics.

This paper briefly discusses several major technical symposia concentrated on topics of concern during 1978. The National Water Well Association and the U.S. Environmental Protection Agency sponsored the National Ground Water Quality Symposium in Minneapolis, Minn., to discuss groundwater pollution and ground-water protection policies. A two-day symposium at the annual meeting of the American Chemical Society in Miami Beach, Fla., highlighted past and present research in water chemistry and effects of radioactive waste disposal on water resources. At the American Water Resources Association meeting in Florida three symposia dealt with the interrelationship of energy, environment, and economics. (Woodard-USGS)
W79-07709

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

MUNICIPAL AND INDUSTRIAL WATER CONSERVATION - THE FEDERAL GOVERNMENT COULD DO MORE,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07881

WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07882

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

WATER RIGHT LAWS AS THEY AFFECT LAND ACQUISITION AND CONSTRUCTION,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
For primary bibliographic entry see Field 4A.
W79-07891

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07893

UPDATING GROUNDWATER LAW: NEW WINE IN OLD BOTTLES,
For primary bibliographic entry see Field 6E.
W79-07894

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

ACREAGE AND RESIDENCY LIMITATIONS IN THE IMPERIAL VALLEY: A CASE STUDY IN NATIONAL RECLAMATION POLICY,
For primary bibliographic entry see Field 6E.
W79-07902

CAPPAERT V. UNITED STATES: A DEHYDRATION OF PRIVATE GROUNDWATER USE,
For primary bibliographic entry see Field 6E.
W79-07904

6E. Water Law and Institutions

OVERCOMING LEGAL AND INSTITUTIONAL BARRIERS TO PLANNED REUSE OF WATER IN THE COLORADO RIVER BASIN,
Denver Research Inst., CO. Industrial Economics Div.
J. G. Milliken, L. C. Lohman, A. S. Trumbly, and L. Roll.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 270, Price codes: A10 in paper copy, A01 in microfiche. Office of Water Research and Technology Report No. OWRT/RU-79/3, April 1979. 211 p, 17 fig, 7 tab, 333 ref. OWRT R-0050 (No. 7816) (1).

Descriptors: *Water reuse, *Institutional constraints, *Policy constraints, *Legal aspects, *Social aspects, *Economic impact, *Planning, Impaired water use, Water allocation(Policy), Water policy, Water resources development, Water utilization, Colorado River Basin.

Research was undertaken to identify and analyze the severity of the legal, institutional, political, and economic obstacles to planned water reuse in the Colorado River Basin, to analyze and assess methods or strategies that aid in overcoming these obstacles, and to develop conclusions on them for the promotion of greater planned reuse within the Basin. Nonagricultural reuse and consumptive reuse of low quality water are emphasized. Barriers to reuse found in interstate and state-specific water allocation law, and in Federal and State environmental laws were identified through legal research; comprehensive interviews with water management officials in the Basin and a document review identified the institutional and political obstacles; available literature was used to document societal positions on different types of water reuse; and the concerns of water reusers were obtained from interviews and documentation. Five case studies of various attempts to reuse water in the Basin were conducted to establish the interaction between reuse barriers and incentives. The strategies found most likely to promote reuse include creative tactics by prospective reusers, strategic actions by State water allocators, and changes in statutes; institutional conflicts were reduced by making benefits visable to parties in conflict. (Davison-IPA)
W79-07502

FRESHWATER USE CUSTOMS ON GUAM-AN EXPLORATORY STUDY,
Guam Univ., Agana. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 299, Price codes: A08 in paper copy, A01 in microfiche. Publication No. 8, 1979. 146 p, 37 fig, 78 ref, 3 append. Stephenson, R.A., Editor. OWRT A-009-GUAM (1), 14-34-0001-8012, 9012.

Descriptors: *Social aspects, Attitudes, History, *Guam, Mariana Islands, Chamorro.

Traditional Chamorro freshwater use customs on Guam still exist, at least in the recollections of Chamorros above the age of 40, if not in actual practice in the present day. Such customs were analyzed in both their past and present context, and are documented. Archaeological evidence suggests a close correspondence between prehistoric settlement patterns and freshwater sources. It is speculated that pre- and post-contact Chamorro living in the northern plateau of Guam may have been involved in reciprocal trading arrangements with sites that had fresh water readily available during dry periods. The perception of freshwater in the Chamorro language context is shown to be

changing. Ethnohistorical studies indicate that availability of freshwater to meet the needs of Guam's people has always been a problem. Sociocultural studies, as gleaned from a questionnaire, on the other hand, suggest that Chamorros over the age of 40 do not recall problems for the most part in their villages of residence and traditional water sources by locally derived names, names that are not often found on present day maps of Guam. Further studies of freshwater use customs on Guam are recommended.
W79-07569

COLORADO GROUND WATER UP FOR GRABS.
Water Well Journal, Vol. 33, No. 6, p 62-74, June, 1979.

Descriptors: *Water rights, *Colorado, *Ground water resources, *Appropriation, Law, Prior appropriation, Legal aspects, Economic feasibility.

The Colorado Constitution established the doctrine of prior appropriation meaning that the first person to claim water and put it to beneficial use has rights to that water perpetually. The 1969 Colorado Water Rights Act states that all water originating in the state, whether surface or underground, is subject to appropriation. However, a new law called SB213 makes land ownership a prerequisite for tapping, non-tributary or bedrock ground waters. Three groups are filing claims to Colorado's unappropriated ground water. They intend to use the water for: large-scale real estate development; trans-mountain diversion of water from western to eastern Colorado; and saltwater fish farms. Even if the claims are granted, it may not be economically feasible to recover the water due to high drilling, pumping, and reclamation costs and water quality problems. (Purdin-NWWA)
W79-07631

IMPACT OF THE LAW REGULATING DRINKING WATER ON WATER RESOURCES MANAGEMENT,
Connecticut University, Storrs, Department of Business Environment and Policy.
M. M. Huffmire.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 762, Price codes: A02 in paper copy, A01 in microfiche. Connecticut University, Storrs, Institute of Water Resources. Research Project Technical Completion Report, 1979. 10 p, 3 ref. OWRT A-079-CONN(1), 14-34-0001-9007.

Descriptors: *Ground water, *Aquifers, *Land use, *Water law, Economics, Connecticut, *Water resources management, *Drinking water supplies, *Safe drinking water act, *Water quality protection, *Investor-owned water companies, *Surplus land holdings, Moratorium on land sales, Surface water impoundments, Legal implications.

Costs of compliance with minimum standards for water quality in Connecticut mandated by the Safe Drinking Water Act have led some investor-owned water utility companies to attempt to dispose of what they argue are surplus land holdings. There is presently a moratorium on the sale of these lands but the question arises as to what will eventually be done with property. The state is considering whether it should grant special assistance to the investor-owned water utility companies in meeting the costs of complying with the Safe Drinking Water Act requirements and what form that aid should take. However, if present and anticipated increases in costs caused by the Safe Drinking Water Act are not eventually passed on to the consumers in the rate base and new methods of funding will be used to insure continued low cost of the resource, demand will be further divorced from supply and market mechanisms will be rendered ineffective. Adequate protection of aquifers and surface water impoundments requires not only continued water company ownership of the land covered by the moratorium, but also that relevant lands within the state are regulated as part of a comprehensive program for protecting present and future drinking water supplies. Where ground water and surface water rights are in conflict, a comprehensive management system should be adopted to establish an order of preferred uses and optimize water availability by providing for conjunctive use of ground water and surface water.
W79-07716

EXISTING STATE AND LOCAL WETLAND SURVEYS (1965-1975). VOLUME II: NARRATIVE,
Martel Labs., Inc., Baltimore, MD.
For primary bibliographic entry see Field 7B.
W79-07726

ASPECTS OF STATE-WIDE EMERGENCY RESPONSE PROGRAMS FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES PROGRAM,
Wiley and Wilson, Inc., Lynchburg, VA.
For primary bibliographic entry see Field 5G.
W79-07797

GUIDANCE ECONOMIC ANALYSIS FOR THE CONCRETE PRODUCTS INDUSTRIES.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-07803

NEW ONTARIO POLICY FOR LOW COST ALTERNATIVES TO COMMUNAL WATER AND SEWAGE TREATMENT,
Ontario Ministry of the Environment (Toronto).
G. Mierzynski.
In: Proceedings of the Seminar on Current Approaches in Wastewater Treatment, April 5, 1978, Ontario Ministry of Health Laboratories, Toronto, Canada, p 1-5 (1978).

Descriptors: *Administration, *Canada, *Septic tanks, *Water wells, *Rural areas, Community development, Cost analysis, Grants, Treatment facilities, Water supply, Waste water treatment, Waste water disposal, Municipal wastes, Domestic wastes.

The Ontario Ministry of the Environment has adopted a policy of providing grants to municipalities for repairing or renewing private systems in defined problem areas where command systems are not cost effective. The average cost per home for communal water and waste treatment facilities, based on 1977 statistics, was $5,500 for water systems and $6,600 for sewage systems. For individual private systems, the costs are about $1,500 for a well and $2,500 for a septic tank and tile field. The new policy extends only to the renewal or repair of existing systems; however, the policy may be extended to new systems in an existing structure located a significant distance from the solution to the water or waste treatment problem and not located in an area of potential growth. The policy will also apply to unorganized communities and small communities with little growth potential which qualified under previous policies. New and novel systems of treatment should be considered along with conventional systems, and combinations of private and communal systems may be possible. (See also W79-07842) (Lisk-FRC)
W79-07843

HIGHLIGHTS OF THE CLEAN WATER ACT OF 1977,
For primary bibliographic entry see Field 5D.
W79-07874

FEDERAL RESERVED WATER RIGHTS SINCE PLLRC,
Wyoming Univ., Laramie.
F. J. Trelease.
Public Land and Resources Law Journal, Vol. 15, No. 2, p 218-36, 1978.

Descriptors: *Reservation doctrine, *Legislation, *Federal reservations, Federal government, Federal-state water rights conflicts, Federal jurisdiction, Prior appropriation, Water policy, Water control, Water law.

When the federal government withdraws a part of its land from the public domain and reserves it for a federal purpose, the government by implication reserves enough of the 'appurtenant' unappropriated water to accomplish the purpose of the reservation. This water right may lie dormant for years. If the government eventually exercizes its reserved right, its priority relates not to the date of use but to the earlier date when the reservation was created. Since the investment and enterprise of the private water user are lost when the government takes the water, the federal reserved water rights are viewed by many as a serious threat to every title to water rights of every stream which touches a federal reservation. The history of the reserved water doctrine, the effects of Supreme Court decisions on the doctrine and the effect the Public Land Law Review Commission on the doctrine are examined. The threat the reserve doctrine poses to private users may be illusory since not a single case of the federal government destroying a private right has been reported. (Vloedman-Florida)
W79-07875

LAND APPLICATION OF WASTEWATER AND STATE WATER LAW: STATE ANALYSES VOLUME II,
Wisconsin Univ.-Madison. School of Law.
D. W. Large.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 975, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-78-175, August, 1978, 197 p.

Descriptors: *Waste water disposal, *State governments, *Water rights, Legal aspects, Water policy, Judicial decisions, Riparian rights, Appropriation, Surface-groundwater relationships, Regulations.

This report's purpose was to: (1) define the legal questions which pertain to land application of wastewater in the context of private water rights law; (2) explain the riparian and appropriation theories; (3) identify the particular aspects of each theory that influence treatment system design and operation; and (4) analyze the private water rights laws of selected states in relationship to land application systems. Hostility to land application systems was not discovered in any of the states' laws analyzed. Occasional uncertainties existed in several states caused by the lack of statutes, regulations, or judicial decisions involving land application. The position of land application systems was strongest in the eastern riparian states. Probably the most favorable eastern states for the land application systems are Florida, Pennsylvania, and Ohio. Each of these states displays a receptiveness toward innovative water uses. The western appropriation states were generally less favorable to land application. This was primarily because the appropriation theory recognizes enforceable rights in all water types, whereas under the riparian theory, such rights are usually limited to watercourses. (Ewing-Florida)
W79-07876

FLOOD PLAIN DEVELOPMENT PRESSURES AND FEDERAL PROGRAMS-PART 1-CASE STUDY ANALYSIS AND RECOMMENDATIONS FOR THE '201' WASTEWATER TREATMENT WORKS PROGRAM,
Research Group, Inc., Atlanta, GA.
L. F. Dean.
EPA 130/1-79-001, May, 1979, 77 p.

Descriptors: *Floodplains, *Waste treatment, *Sewage treatment, *Regional analysis, Legal aspects, Administrative agencies, Administrative decisions, Federal government, Environmental effects, Environmental control, Land use.

Between October, 1977 and June, 1978, a study of floodplain development pressures and federal programs was carried out. Recommended are ways in which the federal Environmental Protection Agency (EPA) can reduce floodplain development pressures caused by the '201' Wastewater Treatment Works Program (WTWP). These recommendations to EPA are based on: (1) 31 case studies of floodplain development pressures in the midwest,

vest, and southeast; (2) meetings with EPA regional offices; (3) interviews with federal officials; nd (4) major decision points in the '201' WTWP vhich can affect floodplain development. The recommendations are: (1) identification of floodplain levelopment pressures during Step 1 facility planning; (2) coordination between the EPA and the Federal Insurance Administration; (3) federal gency coordination for mitigation of floodplain mpact; (4) definition of criteria and standards for loodplain development impacts. Although the tudy's results cannot be generalized to all communities receiving wastewater treatment facilities, the nformation obtained has important implications or the implementation of floodplain development mpact policies by EPA. (Ewing-Florida)
W79-07877

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

DIFFUSE SOURCE POLLUTION: POLICY CONSIDERATIONS FOR THE STATES.
Council of State Governments, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 493, Price codes: A04 in paper copy, A01 in microfiche. March 1977, 47 p.

Descriptors: *Water pollution sources, *Political constraints, *Regulation, Water pollution, Standards, Control, Monitoring, Institutional constraints, Deterioration.

The control of nonpoint sources of water pollution, or diffuse source pollution, is one of the most pressing environmental issues confronting state governments. The problems and opportunities of implementing successful programs to control diffuse sources are explored. The introduction gives a detailed explanation of what diffuse source pollution is, or the issues involved in managing diffuse source pollution, and the reasons for state concern. Part two explores state and federal programs regulating diffuse pollutions when diffuse source pollution had not yet been recognized as a pollution class. The Clean Air Act and the Federal Water Pollution Control Act, each recognizing a part of the diffuse source pollution issue, are extensively analyzed and criticized. Part three gives suggestions for implementing diffuse source pollution programs. The report calls for the states, in active cooperative partnership with local governments, to take the lead in meeting the problem to prevent a stronger federal role. Realistic and dependable federal finding of state programs and rational federal timing and dead lines are suggested. Included are an appendix suggesting future directions and research agenda, and an extensive bibliography. (Coffey-Florida)
W79-07879

THE NATIONAL FLOOD INSURANCE PROGRAM REVISITED - AN UPDATED MODEL ORDINANCE FOR IMPLEMENTATION OF ITS LAND MANAGEMENT CRITERIA,
Florida Univ., Gainesville.
F. E. Maloney, and D. C. Dambly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 483, Price codes: A03 in paper copy, A01 in microfiche. Florida Sea Grant College Program Technical Paper No. 3, December 1977, 46 p.

Descriptors: *Flood protection, *Flood plain insurance, *Flood plain zoning, *Flood plains, Planning, Land use, Land management, Insurance, Hazards, Regulation, Zoning.

In 1975, a model flood plain zoning ordinance was developed to assist communities in implementing the land management regulations adopted as part of the National Flood Insurance Program (NFIP). In 1976, the Federal Insurance Administration published the final land use regulations adopted under the NFIP Significant differences between the proposed and final regulations led to an updated model ordinance. Included is the entire updated model ordinance with commentary. The Model Flood Plain Management Ordinance contains the following: Section (1) Statutory authorization, findings of fact, purposes and objectives; Section (2) Definitions; Section (3) General provisions, and establishment of official zoning map; Section (4) Administration, creation of the flood plain administrator and flood plain construction authorization permits; Section (5) Establishment of zoning districts; Section (6) Floodway districts; Section (7) Flood fringe districts (FFD), the requirements within FFD, and areas of shallow flooding; Section (8) Coastal high hazard districts (CHH), requirements for development in CHHD's, and guidance of future development; Section (9) Floodproofing; Section (10) Variances, requirements and procedures; Section (11) Nonconforming uses; Section (12) Subdivision regulation in flood hazard zone; Section (13) Penalties for violations; and regulation in flood hazard zone; Section (13) Penalties for violations; and Section (14) Severability. (Fortin-Florida)
W79-07880

MUNICIPAL AND INDUSTRIAL WATER CONSERVATION - THE FEDERAL GOVERNMENT COULD DO MORE,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 487, Price codes: A05 in paper copy, A01 in microfiche. Report to the Congress, April 3, 1978, 39 p, 12 append.

Descriptors: *Water conservation, *Water supply, *Federal government, Water consumption, Water demand, Water pressure, Water shortage, Planning, Water use, Conservation.

An adequate water supply is essential to the nation's citizens and industries. If demand continues to increase, the nation will have to develop new supplies or use existing supplies more efficiently. Although the policy of Congress is that state and local governments are primarily responsible for water supply and regulation of water use, various federal programs offer numerous opportunities for encouraging and implementing water conservation programs. Federal agencies can: (1) provide funds for water resource planning; (2) construct dams and reservoirs to increase the supply; (3) construct and operate buildings and housing where water conservation can be undertaken; and (4) provide grants for construction of wastewater treatment facilities. Conservation is beneficial because it frees present supplies, precludes construction of supply and treatment facilities, and reduces future requirements for wastewater treatment facilities. An overview of opportunities for conserving municipal and industrial water supplies is provided which includes: (1) conservation techniques, including domestic water saving devices, metered usage, pricing structures, leakage control, water pressure control and educational compaigns, and (2) the potential for increased water conservation through existing federal programs. (Fortin-Florida)
W79-07881

WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES,
General Accounting Office, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 171, Price codes: A04 in paper copy, A01 in microfiche. July 28, 1977, 46 p.

Descriptors: *Water resource development, *Water management, *Water supply development, Water supply, Water demand, Water consumption, Water utilization, Resource allocation, Planning.

While the United States has an abundant water supply, the geographical distribution and availability of its water resources often do not match needs and demands. Existing and emerging water supply problems are identified. The focus is on the water and water-related programs and activities concerned with water resources planning, management, and development projects designed to provide adequate water supplies to meet present and future demands. Water resources planning encompasses assessing quantity and quality of water supplies, forecasting demands, analyzing problems, and preparing proposals for resolving such problems. Water resources management covers water allocation among competing uses, technology development, and implementation of activities to reduce demand and conserve supplies. Water resource development projects are primarily concerned with project formulation, justification and construction. The current drought in the midwest and west with its devastating economic, environmental, and social impacts highlights the seriousness of the water problems facing our nation. Finding solutions to our water problems requires the establishment of clear priorities and timely and responsive implementing programs. (Fortin-Florida)
W79-07882

A REVISION OF EXISTING REGULATIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 162, p 37078-37134, August 21, 1978.

Descriptors: *Discharge, *Federal jurisdiction, *Administration, *Water pollution control, Pollution abatement, Drainage engineering, Administrative agencies, Permits, State governments, Water pollution, Waste water.

Parts of the existing National Pollutant Discharge Elimination System (NPDES) regulations either are too terse to provide meaningful guidance, or leave significant permit-related issues unaddressed. Based upon several years of hearings by the federal Environmental Protection Agency the proposed regulations for part 124 provide more detailed procedures; parts 122 and 125 provide guidance on substantive questions formerly unaddressed in regulations. Accordingly four new parts of title 40 have been established, incorporating all of existing parts 122, 123, 124, 125 and 402, and portions of $6.900. There were three purposes behind these extensive revisions: (1) To clarify and improve existing program regulations and procedures in light of past experience; (2) To fill in significant gaps in coverage under existing regulations, particularly in response to court decisions and emerging emphasis on the control of toxic and hazardous pollutants; and (3) to make the necessary regulatory changes under the 1977 amendments to the Clean Water Act. (Fortin-Florida)
W79-07883

FEDERAL WATER POLLUTION CONTROL ACT CONSTRUCTION GRANTS,
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 80, p 17690-720, April 25, 1978.

Descriptors: *Federal water pollution control act, *Water pollution control, *Grants, *Administrative agencies, Regulation, Environmental control, Administration, Pollution abatement, Water pollution, Water policy, Contract administration.

These proposed changes to the regulations governing grants for construction of publicly-owned treatment works are intended to implement certain amendments to sections 201 (g), 201 (i), 202 (a), 203 (e) and 304 (d) of the Federal Water Pollution Control Act (FWPCA). The proposed regulations involve innovative and alternative technologies, recreational and open space uses and the provision of assistance by the federal Environmental Protection Agency (EPA) to grant recipients. Regulations that implement amendments to the FWPCA which affect waste water treatment works construction grant programs are administered by the EPA. These regulations deal primarily with the following subjects: (1) State priority; (2) grant eligibility categories; (3) Land eligibility; (4) user charges; (5) industrial cost recovery; (6) grants for

individual systems; (7) combined steps 2 and 3 grants; (8) training facility grants; (9) Buy America, cost-effectiveness analysis; and (10) reserve capacity. An interim regulation implements section 205 (g) of the FWPCA. These regulations make funds available to states to manage the construction grant program, to hire qualified staff and to provide training necessary to effectively carry out delegated functions. (Fortin-Florida)
W79-07884

THE ECONOMIC IMPACT OF ALTERNATIVE CYANIDE STANDARDS IN ILLINOIS,
IIT Research Inst., Chicago, IL.
L. Huff, and J. Huff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 179, Price codes: A13 in paper copy, A01 in microfiche. Illinois Institute for Environmental Quality Doc. No. 77/3, March, 1977, 288 p.

Descriptors: *Illinois, *Standards, *Effluents, *Water pollution, *Environmental effects, Economics, Economic impact, Cost-benefit analysis, Chemical wastes, Water quality control, Water quality standards, Regulation, Industrial wastes.

The objective of effluent and water quality standards is protection of the rivers and the streams and their bodie biota. Modifications to the present cyanide effluent standard have been proposed by the Illinois Petroleum Council, Metropolitan Sanitary District of Greater Chicago, and Republic Steel. To determine an appropriate standard based on an economic analysis, the magnitude of the existing problem was delineated. Four major segments discharge cyanide in Illinois: (1) steel producing; (2) petroleum refining; (3) platers; and (4) municipalities. Seventy dischargers in 10 categories were committing cyanide discharge violations. Effluent regulations are used to maintain a certain level of water quality. Such regulations impose costs on one group while others benefit from the water quality. Complete waterway protection for all uses is attained at the most stringent effluent standard. At increasing effluent levels, some incremental damage may occur to the environment. The existing cyanide effluent standard, if rigorously enforced, will result in substantial monetary loss in Illinois industrial output. With a standard allowing more effluent the decrease in costs imposed is greater than the increase in possible environmental damage. (Ewing-Florida)
W79-07885

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NON-POINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

COAL MINE WATER POLLUTION - LEGAL AND REGULATORY ISSUES: A SURVEY,
For primary bibliographic entry see Field 5B.
W79-07887

WETLANDS RELATED LEGISLATION IN THE UNITED STATES,
Miami Univ., Coral Gables, FL. School of Law.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 660, Price codes: A05 in paper copy, A01 in microfiche. Sea Grant Special Report No. 11, May, 1977. 14 p, 1 append.

Descriptors: *Wetlands, *Legislation, *Regulation, *Coasts, State governments, United States, Water policy, Administrative agencies, Land management, Land use, Marshes, Swamps.

Commensurate with increased concern for the environment is a growing realization of the need for special protection of certain areas that have exceptional environmental importance. Wetlands in their natural state serve a number of important functions for both man and the general environment. Largely unbridled and unregulated development resulted in destruction of large wetlands areas. State legislatures gradually responded to the public outrage that followed. Several methods of general administration of wetlands legislation are described and discussed. A state regulation for the protection of wetlands may constitute a taking of a landowners property for which just compensation is required. A taking occurs under the 14th Amendment when the regulation deprives a landowner of all reasonable (economical) use of his property. Arranged in a state-by-state order, this publication lists statutes, provides definitions, explains briefly prohibited activities, lists administrative schemes and gives standards for the use and development of both inland and coastal wetlands of the United States. (Fortin-Florida)
W79-07888

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

WATER RIGHT LAWS AS THEY AFFECT LAND ACQUISITION AND CONSTRUCTION,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
For primary bibliographic entry see Field 4A.
W79-07891

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07893

UPDATING GROUNDWATER LAW: NEW WINE IN OLD BOTTLES,
R. J. Adams.
Ohio State Law Journal, Vol. 39, No. 3. p 520-41, 1978.

Descriptors: *Ohio, *Groundwater, *Groundwater resources, Water supply, Water shortage, Water policy, Water law, *Water allocation(Policy), Water resources, State governments, Legislation, Common law.

There has been considerable talk of an impending water crisis. Groundwater may be called upon to fill an increasing proportion of total water demand. Groundwaters are typically usable without the vast expenditures necessary to build dams and acquire surface acreage to be flooded. Groundwaters frequently have useful characteristics not shared with surface waters: (1) uniformity of temperature and composition and (2) relative freedom from pollution. Groundwater use is increasing at a rate faster than surface water use. This has heightened concern in Ohio about the ability of common-law rules to continue beneficial, efficient and equitable distribution of existing groundwater resources. Concern about conflicts between competing users resulted in new legislation which allows the Ohio Division of Water to intercede as a fact finder, but which does not affect the legal rules for allocating groundwater. A fundamental allocation question has become more important: Should Ohio continue to distribute groundwater according to the presently used absolute ownership rule. The 'knowledge doctrine' should be adopted. This doctrine is easily integrated with surface water management rules, and is consistent with the common law and Ohio law. (Ewing-Florida)
W79-07894

WATER WAY PRESERVATION: THE WILD AND SCENIC RIVERS ACT OF 1968,
S. K. Goodell.
Boston College Environmental Affairs Law Review, Vol. 7, No. 1, p 43-82, 1978.

Descriptors: *Rivers, *River regulation, *Wild river act, *Ecology, Water law, Legal aspects, Conservation, Federal government, State governments, Legislation, Regulation, Environmental effects.

This country's rivers have fallen victim to excessive industrialization, abusive land use, and an overall move to commercialize the recreational value of free-flowing rivers. In 1968, Congress passed the Wild and Scenic Rivers Act to prevent the decay of free-flowing rivers. Many states have responded with 'mini-wild and scenic river systems.' This response has created a fairly comprehensive regulatory network with the potential to protect many valuable waterways. The federal wild and scenic rivers system and its impact on waterway preservation over the last ten years are reviewed. The legislation's mechanics are analyzed with emphasis on two major problems: delays and increased costs. Causes of these problems are discussed and solutions suggested. Various state systems are surveyed. In particular, the Oregon wild and scenic rivers program is examined to consider the possible application of certain state preservation devices to the federal system. Realizing the delicate balance between the conservation efforts of the Act and conflicting private property interests is discussed in the context of the New River controversy - an example of the problems created when the equilibrium between these two interests is disturbed. (Ewing-Florida)
W79-07895

GROUND AND SURFACE WATER IN NEW MEXICO: ARE THEY PROTECTED AGAINST URANIUM MINING AND MILLING,
K. K. Townsend.
Natural Resources Journal, Vol. 18, No. 4, p 941-62, October, 1978.

Descriptors: *New Mexico, *Groundwater, *Water pollution, *Uranium radioisotopes, Legislation, Environmental effects, Federal water pollution control act, Water pollution sources, Legal aspects, Effluents, Water law.

The uranium companies' methods of mining, milling, and waste disposal affect both surface and ground waters in New Mexico. Both federal and state legislatures have enacted statutes, the Federal Water Pollution Control Act (FWPCA) and the N. M. Water Quality Act, intended to balance the need to protect water with the need to produce uranium. The federal Environmental Protection Agency is reluctant to incorporate the New Mexico's groundwater regulations and control discharges upstream from the National Pollution Discharge Elimination System outfall. This reluctance exemplifies one of the major difficulties in controlling uranium companies-lack of resources. Another problem is that uranium companies can prolong adjudicatory hearings for many years, and may successfully thwart the state's regulation. If the New Mexico court is swayed by the companies' argument, it may be another five years until discharges are controlled. Both the federal act and state regulations should be much stronger. Discharges to groundwater should be controlled by the FWPCA. (Ewing-Florida)
W79-07896

HARBOR LINES AND THE PUBLIC TRUST DOCTRINE IN WASHINGTON NAVIGABLE WATERS,
Washington Univ., Seattle. School of Law.
For primary bibliographic entry see Field 4C.
W79-07897

SAVING THE COAST: THE BRITISH EXPERIENCE,
Saint Catherine's Coll., Cambridge (England).
J. A. Steers.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 7-22, 1978, 1 fig.

Descriptors: *Foreign countries, *Coasts, *Conservation, Ecology, Shores, Environment, Environmental effects, Planning, Protection, Land resources.

since the mid-twentieth century, steps have been aken to conserve the Great Britain coast. Official nd unofficial bodies have interacted to try to save he coast. Prior to 1965, the National Parks Com-nittee and Nature Conservancy worked as inde-endent bodies with coastal conservation and pro-ection at the forefront of their activities. In 1965, he National Environment Research Council was reated to encourage and support research in the arth sciences and ecology, disseminate advice and nowledge, establish and manage nature reserves, nake grants and appoint committees. National and ocal trusts have also played an important role in aving parts of the coast. Many local coastal re-erves are concerned with smaller areas. Many nstances of coastal alteration can be cited, includ-ng planned residential development and the results f oil discovery. The country is now aware of langers which could result from such changes. The essential point is that all interests must be liscussed and assessed before any part of the coast s to be developed. (Ewing-Florida)
W79-07899

RE-EMERGENCE OF A CONTROVERSY: EN-FORCING ACREAGE LIMITATION,
C. H. Coleman.
Harvard Environmental Law Review, Vol. 2, p 329-41, 1978.

Descriptors: *Agriculture, *Land use, *Water users, *Irrigation, Judicial decisions, Administrative agencies, Farms, Cost-benefit theory, Environmental effects, Legislation.

In 1902, Congress passed the Reclamation Act. The purpose was to encourage the development of small family farms in the west. The Act required water users to reside on the irrigated land and limited to 160 acres the amount of land any one landowner could irrigate with federally-provided water. Some felt the Act was unenforceable, and hampered economically-efficient agricultural development. Others believed it the best means of preventing monopoly of land and water. An uneasy compromise resulted. Neither provision was repealed, but the pattern of enforcement included many special exemptions and modifications, listed here. Three court decisions and Department of Interior's proposed regulations indicate a trend toward a stricter enforcement policy. The implications of the recent decisions, including their potential impact on the environment, are explored. The stricter enforcement policy raises difficult questions, such as, how widespread the effects of the proposed rules will be, whether advances in farm technology have made 160-acre farms economically unfeasible, and whether the federal government should continue to subsidize project-water users. (Horwich-Florida)
W79-07900

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
M. M. Eisenstadt.
Natural Resources Journal, Vol. 18, No. 3, p 521-44. July, 1978.

Descriptors: *Hydrogen, *Water utilization, *Energy, *Energy conversion, Federal water pollution control act, Prior appropriation, Brackish water, Acquifers, Surface water, Water law, Water supply, Water demand, Economics.

Solar energy is a prime candidate as a source for hydrogen production. The areas of the United States that receive the most sunlight are the southwestern states and Florida. If hydrogen economy becomes a reality and southwestern surface water is used for hydrogen production, the water requirements could dry up the southwestern rivers. The economic and technological aspects of the problems involved in using brackish water, from isolated acquifers, for hydrogen production indicate that both the water and technology are presently available. The legal problems are no more complicated than those dealing with surface water. While the cost of using brackish water would be slightly higher than that of fresh water, the cost might be justified, for brackish water would prevent damage to both the ecology and southwestern citizens' lifestyle. Under its police power, the federal government could acquire as much surface water as needed to produce hydrogen. Commentators say the environmental damage must be balanced against the economic advantage of using surface water instead of brackish groundwater. (Fortin-Florida)
W79-07901

ACREAGE AND RESIDENCY LIMITATIONS IN THE IMPERIAL VALLEY: A CASE STUDY IN NATIONAL RECLAMATION POLICY,
A. K. Kelley.
South Dakota Law Review, Vol. 23, No. 3, p 621-61, Summer, 1978.

Descriptors: *Reclamation, *Irrigation, *Judicial decisions, Irrigation programs, Legislation, Arid lands, Water delivery, Water distribution, Legal aspects, Water policy, Water resource development.

Since the turn of the century, irrigation in the arid areas of the western United States has become important. Much of the irrigation is made possible by federal reclamation projects. A controversial issue that arises regularly is who shall benefit from the water provided from these projects. Parties ranging from large corporate agricultural combines to the poorest of migrant farm workers have become aware of the opportunities presented by this 'liquid gold'. The areas receiving the greatest amount of commentary are the acreage limitation and the residency requirement, which limit water delivery from federal reclamation projects. In the case of United States v. Imperial Irrigation, the Ninth Court of Appeals had to decide whether restrictions should be placed upon water delivery in the prosperous Imperial Valley. Unfortunately, the court used an inflexible standing test to avoid analyzing the extremely significant residency requirement issue. The court's treatment of the acreage limitation question, demonstrated a proper recognition of the vital policies forming the foundation of the reclamation laws. (Fortin-Florida)
W79-07902

RESERVED WATER RIGHTS, INDIAN RIGHTS AND THE NARROWING SCOPE OF FEDERAL JURISDICTION: THE COLORADO RIVER DECISION,
Wayne State Univ., Detroit, MI. Coll. of Law.
R. H. Abrams.
Stanford Law Review, Vol. 30, No. 6, p 1111-48, July, 1978.

Descriptors: *Federal-state water rights conflicts, *Water rights, *Federal jurisdiction, Judicial decisions, Jurisdiction, Water law, Indian reservations, State jurisdiction, Federal government, Arid lands.

In 1976, the United States Supreme Court decided Colorado River Water Conservation District v. United States. The court held that principles of judicial administration relating to the 'contemporaneous exercise of concurrent jurisdictions' require that federal courts abjure congressionally granted, previously-attached jurisdiction of federal claims to reserved water rights. By establishing state courts as the primary forum for adjudicating all water rights within state boundaries, this decision dramatically extends state courts' control over reserved rights claims. This includes claims by the federal government as trustee for American Indian lands withdrawn by treaty or other congressional action. Although the decision did not abolish concurrent jurisdiction, it virtually assured adjudication of all claims in state courts. State courts may discriminate against federal claims in favor of state and private uses. The arguments favoring a federal forum are especially strong for reserved rights claimed on behalf of American Indians. Either the Court should reexamine the Colorado River decision, or, Congress should clarify the McCarron Amendment. Otherwise, the federal district courts must strike a new balance on a case-by-case basis, by declining to dismiss or remand Indian reserved rights claims. (Fortin-Florida)
W79-07903

CAPPAERT V. UNITED STATES: A DEHYDRATION OF PRIVATE GROUNDWATER USE,
M. P. Bouret.
California Western Law Review, Vol. 14, No. 2, p 382-417, 1978.

Descriptors: *Federal-state water rights conflicts, *Groundwater, *Water rights, *Reservation doctrine, Federal government, State governments, Judicial decisions, Implied benefits, Arid lands, Underground, Prior appropriation.

During the last twenty years, the relationship between the western states and the federal government regarding water rights has steadily deteriorated. The problem was recently exacerbated by the United States Supreme Court in Cappaert v. United States. The Court held that when the federal government established Devils' Hole National Monument in Nevada, it impliedly reserved rights to unappropriated underground water which could not be lawfully encroached upon by adjacent landholders. The implied reservation doctrine was expanded for the first time to underground waters. When the federal government reserves land, it also reserves sufficient water to accomplish the purpose for which the land was taken. Landowners adjacent to the federal reservation have no idea how the governments' needs will affect their water supply until notified that their water use must be stopped or curtailed. This may be a taking of lands without prior notice and any compensation. The future demand for underground water supplies in the public and private sectors mandates a quantification of recordation of, and compensation for surface and underground water rights. (Fortin-Florida)
W79-07904

ACID COAL MINE DRAINAGE: PAST POLLUTION AND CURRENT REGULATION,
West Virginia Univ., Morgantown. Coll. of Law.
P. C. McGinley, and J. J. Sweet.
Duquesne Law Review, Vol. 17, No. 1, p 67-97, 1978-79.

Descriptors: *Acid mine water, *Mine acids, *Mine drainage, Mine waters, Mine wastes, Federal water pollution control act, Mining, Pollutants, Water pollution, Water pollution effects.

A cornerstone of the Carter Administration's energy program is the use of the country's extremely large bituminous coal reserves as a primary fuel source. The coal fuel cycle has an impact on air, water and land quality, and plant and animal life. Perhaps the most serious environmental problem with the mining of bitumenous coal is the production of the ecologically damaging acid mine drainage (AMD) from deep and surface mines. An analysis of the early AMD cases suggest a judicial acceptance of the inevitability of such pollution. A practical and economically feasible method of treatment or abatement was not believed to exist. The court's failure to impose effective restraints on coal operators for AMD pollution, which occurs during and after mining, provided the coal industry substantial incentive to develop new abatement technologies. Only since the enactment of the Federal Water Pollution Control Act and vigorous enforcement of state environmental protection laws have great strides been made in developing and applying effective AMD abatement technology. (Fortin-Florida)
W79-07905

RECENT CONGRESSIONAL ACTION ON OUTER CONTINENTAL SHELF OIL AND GAS DEVELOPMENT,
F. Craft, Jr.
Tulsa Law Journal, Vol. 13, No. 4, p 742-50, 1978.

Descriptors: *Continental shelf, *Legislation, *Oil, Coasts, Oil wells, Legal aspects, Administrative agencies, State governments, Federal jurisdiction, Federal state water rights conflict.

The energy crisis has increased the demand for oil and gas production from the ocean floor adjoining the United States coast. These demands conflict with the need to avoid ocean pollution and pre-

serve the coastal environment. The issue is further aggravated by jurisdictional assertions between the federal and state governments and among member nations which will meet at the 1978 United Nations Conference on the Law of the Seas. The relevant issues in the Outer Continental Shelf bill are: (1) whether to lease before or after all environmental questions are answered; (2) whether to accelerate or halt leasing until the need has been thoroughly demonstrated; (3) how much influence state and local governments should have in development; (4) what revisions of the bidding system are necessary; and (5) what types of antitrust reviews should be available. Unfortunately, Congress to date has ignored the need to increase domestic production. Congress is still preoccupied with enacting environmental legislation which grew out of the causes of the early 1970's. (Fortin-Florida)
W79-07906

ASSESSMENT OF CIVIL MONETARY PENALTIES FOR WATER POLLUTION: A PROPOSAL FOR SHIFTING THE BURDEN OF PROOF REGARDING DAMAGES,
D. P. Taylor.
Hastings Law Journal, Vol. 30, No. 3, p 651-82, January, 1979.

Descriptors: *Water pollution, *Damages, *Penalties, *Economics, Water quality, Legislation, Judicial decisions, Administrative agencies, Effluents, Cost allocation, Compensation.

The issue of assessing and imposing the appropriate amount of civil and monetary penalties for violation of water quality statutes is not unique to California; it arises in many other states and at the federal level because such penalties have become a key enforcement remedy in environmental legislation. Depending on the particular statutory scheme, such penalties may be assessed and imposed by administrative agencies or by the courts. The efficiency of the penalties is determined largely by the method of assessment and imposition used. Uncertainty often arises in judicial assessment proceedings because it is unclear what need be proved and by whom under the penalty statute. Effective water pollution enforcement will be frustrated of the state is required to bear the burdens of proof concerning damages. The proposal is that a showing of statutory violation would raise a rebuttable presumption of a maximum $10,000 per day penalty. This amount is considered appropriate to deter future violation and compensate for unquantifiable harm. The polluter then must prove a lower amount was warranted. (Fortin-Florida)
W79-07907

PROTECTING MASSACHUSETTS WETLANDS,
Suffolk Univ., Boston, MA.
A. D. Dawson.
Suffolk University Law Review, Vol. 12, No. 4, p 755-95, 1978.

Descriptors: *Regulation, *Wetlands, *Floodplains, *Massachusetts, Land fills, Coastal marshes, Zoning, Permits, Floods, Flood control, Flood protection, Water supply, Natural resources, Marshes, Compensation, Excavation, Shores, Navigable waters, Tidal waters, Constitutional law.

Massachusetts has enacted a variety of laws designed to protect wetlands and floodplains. State and local regulatory activity has produced much litigation. Massachusetts' case law may foreshadow decisions elsewhere as environmental laws collide with the expanding interests of private landowners. Massachusetts cases and references to the decisions from other states that have most influenced Massachusetts courts in providing wetland protection are concentrated upon. There are four parts: (1) an overview of Massachusetts statutes; (2) a discussion of judicial decisions concerning wetlands, including a detailed analysis of the most recent case, MacGibbon v. Board of Appeals of Duxbury (MacGibbon III). MacGibbon III may signal a reversal of the liberal trend regarding the taking issue in environmental cases; (3) a comparision of MacGibbon III with other states' decisions; and (4) a summary of lessons derived from Massachusetts cases and statutes, which may be useful to lawyers, legislators and administrators who seek to protect wetlands through governmental regulation. (Coffey-Florida)
W79-07908

CURRENT GROUNDWATER LAW IN ARIZONA,
M. N. Goodman.
Arizona State Law Journal, Vol. 1978, No. 2-3, p 205-24, 1978.

Descriptors: *Arizona, *Groundwater, *Legislation, *Regulation, Legal aspects, Water law, Water policy, Water supply, Federal government, State governments.

The state of groundwater law in Arizona has never been certain. Historical developments are unraveled to determine whether they are useful in interpreting the 1977 Groundwater Act (Act) in developing a sound water policy for the future. Three aspects of the Act apt to provoke more litigation are examined. These provisions relate to: (1) groundwater transfers; (2) rights, liabilities and remedies under the Act; and (3) a moratorium on the establishment of additional critical groundwater areas. The Groundwater Management Study Commission created by the Act and the constitutional problem it raises are viewed. The implied reservation problem resulting from the federal litigation is discussed. The Arizona legislature has acted occasionally to relieve the pressures created by the water scarcity, but it appears to act more out of desperation than determination to resolve a serious problem. The Act is no exception. It is a stop-gap measure which seems to raise more problems than it solves. (Ewing-Florida)
W79-07909

FEDERAL ENFORCEMENT PROCEEDINGS UNDER THE 1977 CLEAN WATER ACT,
S. L. Hartman.
Temple Law Quarterly, Vol. 51, No. 4, p 884-911, 1978.

Descriptors: *Federal government, *Legislation, *Regulation, *Water pollution control, Federal water pollution control act, Water quality control, Waste treatment, Legal aspects, Water law, Standards, Water pollution.

The 1977 Clean Water Act (CWA) amended the Federal Water Pollution Control Act (the Act). The amendments' enactment signified a growing Congressional awareness that cleaning up this nation's waters will be a more complex task than initially anticipated. The failure of the Act to provide for flexibility in enforcing 1977 deadlines would have created a near impossible task for the federal Environmental Protection Agency and the courts. While addressing itself to the problem of such inflexibility, the CWA has serious deficiencies. Congress has given relief to sewage treatment works unable to achieve compliance due to inadequate or nonexistent federal funding, but the relief was only helpful to relieve past funding deficiencies. The relief does not extend to future difficulties. Although state and federal roles in the National Pollutant Discharge Elimination System program have been clarified, the CWA provides no guidance if permits or guidelines are issued in an untimely manner. To the extent that these problems remain in the Act, Congress has failed to ease the burden on the administrative and judicial processes. (Ewing-Florida)
W79-07910

THE LOSS OF PUBLIC TIDELANDS TO PRIVATE PARTIES THROUGH UNCONSTITUTIONAL LAND TRADES,
L. Martyn, and H. Bohner.
San Francisco University Law Review, Vol. 13, No. 1, p 39-61, 1978.

Descriptors: *California, *Coasts, *Land resources, *Public rights, Public lands, Legal aspects, Legislation, Constitutional law, Control, Judicial decisions, Conservation.

In 1850, California became the owner of all the land in the state subject to the ebb flo and flow of the tide. These public tidelands are being filled and lost to private development despite provisions of the California Constitution which prohibit private ownership and monopoly of the tidelands. If the provisions of the California Constitution were enforced, loss of the tidelands to private development could be substantially reduced or halted. The loss of the tidelands is due, at least in part, by the state's failure to properly map and inventory its tidelands and by unconstitutional exchanges of tideland between state and private developers. Measures could be taken to alleviate further inroads into public trust lands: (1) Public Resources Code section 6307, authorizing exchange of state-owned lands for private lands of equal value, should be declared unconstitutional; (2) courts should stringently review any legislative determination freeing tidelands from the public trust; and (3) revenue from oil and minerals derived from patented tidelands should belong to the state tidelands trust fund. (Ewing-Florida)
W79-07911

PUEBLO INDIAN WATER RIGHTS: WHO WILL GET THE WATER,
A. P. Maynez.
Natural Resources Journal, Vol. 18, No. 3, p 639-58, 1978.

Descriptors: *New Mexico, *Pueblo water rights, *Reservation doctrine, Water law, Judicial decisions, Legal aspects, Appropriation, Federal-state water rights conflicts, Federal government, Water control.

The basic issue before the court in New Mexico v. Aamodt was whether Pueblo water uses were controlled by state water law based on the doctrine of prior appropriation. The court held that pueblo water rights were not subject to state law. Court decisions have placed the pueblos firmly under the protection of the federal government. The court suggested that the pueblo water rights may be reserved rights. The landmark case defining reserved rights is Winters v. United States. The Winters Doctrine states that a land reservation established by treaty carries with it an implicit reservation of water, the amount being determined by the purpose of the reservation. The doctrine has not been confined to lands reserved by treaty. The court's suggestion, that the Pueblos may have reserved rights, may become the formulation of a new test. Under this test, the existence of such a right depends not upon whether there is a federal land reservation but upon whether there is federal control through guardianship over the land. This new test is a logical extension and refinement of the Winters Doctrine. (Ewing-Florida)
W79-07912

GROUNDWATER - A FILTER FOR A MUDDY ISSUE. (LANDOWNERS' RIGHTS TO GROUNDWATER AS GOVERNED BY THE NEBRASKA PREFERENTIAL USE STATUTE),
A. R. Bosch.
Creighton Law Review, Vol. 12, No. 1, p 431-45, Fall, 1978.

Descriptors: *Nebraska, *Groundwater resources, *Water allocation(Policy), Water policy, Water supply, Water resources, State governments, Judicial decisions, Legal aspects, Groundwater.

In the recent case of Prather v. Eisenmann, the Nebraska Supreme Court clarified Nebraska law on groundwater use. There are four basic legal theories governing groundwater use: (1) the English/absolute ownership rule; (2) the American/reasonable use rule; (3) the California/correlative rights doctrine; and (4) the prior appropriation rule. The English rule states that the landowner has an absolute right to take the water beneath his land for any use, regardless of the effect on an adjoining landowner. The American rule limits a landowner's use to beneficial purposes having a reasonable relationship to his overlying land, regardless of the effect on the water supply to adjacent landowners. The correlative rights doctrine gives each landowner an equal and correlative

right to make beneficial use of the groundwater. The prior appropriation doctrine grants priority to the first person who adopts a beneficial use of the water. Although Prather discussed the development of groundwater law, the decision was based soley on the Nebraska Preferential Use Statute which provides that preference in the use of underground water shall be given to those using the water for domestic purposes. (Ewing-Florida)
W79-07913

PROPOSED RULES FOR ADMINISTERING THE ACREAGE LIMITATION OF RECLAMATION LAW,
N. Jones.
Natural Resources Journal, Vol. 18, No. 4, p 933-40, October, 1978.

Descriptors: *Reclamation, *Regulation, *Legislation, *Irrigation water, Federal government, Judicial decision, Legal aspects, Irrigated land, Irrigation, Land use, Administration.

In a recent Ninth Circuit Court opinion, the limitation on land an individual may own in an irrigation district receiving federal reclamation water was applied to California's Imperial Irrigation District. The current acreage limit of 160 acres was adopted in the 1926 Omnibus Adjustment Act, but has not been enforced. Pursuant to court order, the Bureau of Reclamation has proposed rules for enforcement of the acreage limitation. The rules restate the purpose of the limitation: (1) to provide for a maximum number of farmers; (2) to widely distribute the benefits; (3) to promote family-sized owner-operated farms; and (4) to preclude speculation. Lands exceeding the acreage limitation may only receive water if the owner executes a recordable contract for sale of that land. Availability notices are then published and the land sold at an approved price. The proposed rules would also: (1) tighten the criteria for eligible purchasers; (2) provide for impartial selection of purchasers; and (3) restrict leasing of the excess lands. Sale and resale prices are subject to approval. Enforcement will meet serious opposition and may disrupt agricultural operations. Such a change in land-use patterns may be unfeasible for present farming methods. (Ewing-Florida)
W79-07914

ACID MINE DRAINAGE AND THE CLEAN WATER ACT,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
S. S. Golfman.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 112-113. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Mine drainage, *Legislation, *Federal Water Pollution Control Act Amendments of 1972, *Pollution abatement, *Water pollution control, Mine wastes, Acid mine water, Water pollution, Water pollution sources, Financing, Government finance, Government support, Maryland.

Active and abandoned mines are given consideration in the water quality management plans to be developed by each State under the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). In Maryland the Bureau of Mines of the Energy and Coastal Zone Administration is responsible for controlling abandoned mine drainage, and water quality associated with active mines is charged to the Water Resources Administration Section 208 of P. L. 92-500 requires the development and implementation of a management plan to identify mine-related sources of pollution, including abandoned surface and underground runoff, and to prescribe methods and procedures to control them. The Federal government provides funds for mine water pollution control demonstrations under Section 107 of P. L. 92-500, but no implementation funds are provided to correct pollution from abandoned mines. The demonstration funds have been used by Maryland and other States to aid in developing abatement techniques. Maryland acknowledged that the responsibility for abandoned mine pollution is statewide by enacting the Abandoned Mine Drainage Control Act, which authorized the prevention, control, and abatement of pollution from abdandoned mines, and provided $5 million to implement the provisions. Other legislation provides for a surcharge of 15 cents/ton of coal mined to be leveled, and a fee of $40/acre of affected land surface to provide a continuous flow of funds for abatement projects. The State will match each $40 put into the fund. (Davison-IPA)
W79-07978

CONGRESSIONAL PERSPECTIVES ON CLEAN WATER,
Committee on Environment and Public Works (U. S. Senate), Washington, DC.
P. T. Cummings.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 179-181. Interstate Commission on the Potomac River Basin, Rockville Md. Technical Publication 78-2.

Descriptors: *Water pollution control, *Pollution abatement, *Legal aspects, *Legislation, *Water Pollution Control Act Amendments of 1972, Water quality control, Water quality standards, Water pollution sources, Committee on Environment and Public Works, Potomac River basin.

The legislative intent behind the 1972 Federal Water Pollution Control Act Amendments (P. L. 92-500) is examined. The full implications of the Act and its philosophy are contained in its first sentence: 'The object of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's Waters.' That congress has declared water pollution illegal is implicit in the no discharge goal of Section 101. To implement the basic decision that the Nation's waters are not to be used for waste disposal, Congress established regulatory and enforcement strategy and a system of subsidies to localities to aid in achieving the goals of the Act. The three basic principles in the act are: (1) to protect and restore the integrity of the natural systems in the Nation's waters, (2) man's activities are presumed to interfere with the Act's objective, and (3) the burden lies on the person who wishes to put something in the water to show that he will not interfere with the means to attain the Act's goals. The intent is to try to make man's activities compatible with the Act rather than restoring Pre-Columbian America. Issues before the Committee on Environment and Public Works for 1977 and 1978 include a review of the act, the mechanisms available for controlling nonpoint sources of pollution, funding of controls for storm-water run-off, the bioaccumulation and persistence of toxic pollutants, and acid mine drainage. (Davison-IPA)
W79-07991

PROTECTING AQUATIC LIFE: WHAT CAN THE LAYMAN DO,
E. Wesely.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 182-184. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Aquatic life, *Preservation, *Protection, *Attitudes, *Social function, Psychological aspects, Social values, Decision making, Social impact, Environmental effect, Social participation, Ecology, Pollution abatement, Water pollution control, Water quality standards.

A board member of the C and O Canal Association expresses his ideas and philosophy concerning the layman's role in protecting aquatic life. Examples are presented of lay participation in preventing the enactment of legislation which would result in environmentally harmful consequences, and grass roots action to seek environmental preservation through legislation. It is thought that a skeptical attitude toward professional studies will aid the layman in maintaining his objectivity with regard to studies which appear to distort his own observations. In testimony before the Maryland Public Service Commission a representative of an institution which had monitored the aquatic environment of the Potomac River at the site of an electric powerplant for several years stated that the plant's discharge water was never sampled. Laymen sampled the plant's discharge plume in preparing evidence for the same hearing. Laymen also produced evidence that the electric power company had been discharging waste fly ash into the C and O Canal for several years. These and other examples of laymen monitoring institutional activity indicate that the role of the layman in protecting the environment is that of the 'watch dog'. (Davison-IPA)
W79-07992

LEGAL AND SCIENTIFIC PERSPECTIVES,
Environmental Defense Fund, East Setauket, NY. Eastern Water Resources and Land Use Program.
J. T. B. Trip, and R. H. Harris.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. D. and Mason, W. T., Eds., 1978. p 185-189, 4 tab, 14 ref. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Federal Water Pollution Control Act Amendments, *Planning, *Water pollution control, *Pollution abatement, *Water quality, *Water quality standards, Water pollution, Management, Legal aspects, Water resources, Protection.

The Potomac estuary is extremely polluted from nutritional inflows from the upper basin, combined sewer discharges in the metropolitan area, and direct discharges from sewage plants. At present no comprehensive plan exists for protecting biological resources, yet waste water treatment plants are being designed and constructed and decisions are being made about the location of discharges to the Potomac basin. Control of toxic pollutants into the Potomac River is essential to protect the biological resources, but little effort has been made to identify and control them, and EPA has not given much guidance in dealing with them. Due to lack of an effective plan to achieve the water quality as set forth in the 1972 Federal Water Pollution Control Act Amendments (FWPCAA), EPA denied application for a construction grant for the Dickerson treatment plant in Montgomery County, Maryland. This is expected to accelerate consideration of land treatment and other alternatives which will meet the standards. It is concluded that the Potomac's ability to support its intended use will not be restored with current waste water management plan development, but that proper waste water management planning as required by the FWPCAA can provide the correct basis for solving the problems. (Davison-IPA)
W79-07993

6F. Nonstructural Alternatives

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

THE NATIONAL FLOOD INSURANCE PROGRAM REVISITED - AN UPDATED MODEL ORDINANCE FOR IMPLEMENTATION OF ITS LAND MANAGEMENT CRITERIA,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-07880

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NON-POINT SOURCE IDENTIFICATION AND AS-

SESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

WETLANDS RELATED LEGISLATION IN THE UNITED STATES,
Miami Univ., Coral Gables, FL. School of Law.
For primary bibliographic entry see Field 6E.
W79-07888

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

ASSESSMENT OF CIVIL MONETARY PENALTIES FOR WATER POLLUTION: A PROPOSAL FOR SHIFTING THE BURDEN OF PROOF REGARDING DAMAGES,
For primary bibliographic entry see Field 6E.
W79-07907

PROTECTING MASSACHUSETTS WETLANDS,
Suffolk Univ., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-07908

6G. Ecologic Impact Of Water Development

OPPORTUNITIES FOR MAINTENANCE REHABILITATION OF RIPARIAN HABITATS: EASTERN UNITED STATES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W79-07518

THE COASTLINE,
For primary bibliographic entry see Field 2L.
W79-07717

LAGOONS,
Ferrara Univ. (Italy). Inst. of Zoology and General Biology.
For primary bibliographic entry see Field 2L.
W79-07719

SALT-MARSHES,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
For primary bibliographic entry see Field 2L.
W79-07721

ESTUARIES,
University Coll. of Swansea (Wales). Dept. of Botany.
For primary bibliographic entry see Field 2L.
W79-07722

VOLUME III. THE WETLANDS/EDGES PROGRAM. RESEARCH ON THE CHESAPEAKE BAY TO PROVIDE A KNOWLEDGE BASE FOR PHYSICAL ALTERATIONS OF THE EDGES OF THE CHESAPEAKE BAY,
Chesapeake Research Consortium, Inc., Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 117, Price codes: A03 in paper copy, A01 in microfiche. Interim Progress Report, February 15, 1974. 32 p, 7 append. NSF/RANN 38973.

Descriptors: *Water resources development, *Shore protection, *Chesapeake Bay, *Permits, *Assessment, Water resources, Water pollution, Wetlands, Shores, Coasts, Environmental effects, Topography, Geomorphology, Analysis, Evaluation, Regulation, Land use, Sedimentation, Erosion.

The design and composition of the program, technical accomplishments, and delivered products concerned with development of criteria for the incremental alteration in the edges of the Chesapeake Bay are presented. Progress of the shoreline situation is also reported. The approach involves: (1) a comprehensive analysis of permit applications for physical alteration of the edges of Chesapeake Bay (approximately 2,000) received by the Corps of Engineers during 1973, (2) detailed case studies of a representative set of permit applications, and (3) specific research projects designed to provide information identified as urgently needed by regulatory agencies for permit proposal decisions. Shoreline studies attempt to obtain a useful characterization and analysis of Chesapeake Bay shorelands with respect to morphological type, land use, and erosion and sedimentation characteristics. Currently, work is focused on the assessment of lower bay shorelands on a county-by-county basis. (Bollinger-Mass)
W79-07724

THE NATURAL RESOURCES OF THE NIPOMO DUNES AND WETLANDS. REPORT NUMBER 15 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07730

THE NATURAL RESOURCES OF AGUA HEDIONDA LAGOON. REPORT NUMBER 16 ON CALIFORNIA COASTAL WETLANDS,
San Diego Univ., CA. Environmental Studies Center.
For primary bibliographic entry see Field 2H.
W79-07731

THE NATURAL RESOURCES OF MUGU LAGOON. REPORT NUMBER 17 ON CALIFORNIA COASTAL WETLANDS,
California Univ., Santa Barbara. Marine Science Inst.
For primary bibliographic entry see Field 2L.
W79-07732

THE NATURAL RESOURCES OF ANAHEIM BAY--HUNTINGTON HARBOUR. REPORT NUMBER 18 ON CALIFORNIA COASTAL WETLANDS,
California State Dept. of Fish and Game, Sacramento.
For primary bibliographic entry see Field 2L.
W79-07733

DEVELOPER'S HANDBOOK,
Connecticut Dept. of Environmental Protection, Hartford. Coastal Area Management Program.
For primary bibliographic entry see Field 6B.
W79-07735

BIOLOGICAL PRODUCTION AND NUTRIENT STUDIES OF LAKE CHAMPLAIN,
Vermont Univ., Burlington. Dept. of Zoology.
For primary bibliographic entry see Field 2I.
W79-07741

EFFECTS OF SPRING WATER LEVELS ON THE REPRODUCTION OF UPPER RICHELIEU AND MISSISQUOI BAY: NORTHERN PIKE (ESOX LUCIUS L.),
Quebec Univ., Montreal (Canada), Dept. of Biology.
For primary bibliographic entry see Field 2I.
W79-07742

LAKE CHAMPLAIN FISHERIES INVESTIGATION: UNITED STATES WATERS,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 2I.
W79-07743

ANALYSIS OF ECONOMIC EFFECTS OF WATER SURFACE ELEVATIONS ON U.S. SHORELINE OF LAKE CHAMPLAIN, NEW YORK AND VERMONT,
URS/Madigan-Praeger, Inc., New York.
For primary bibliographic entry see Field 6B.
W79-07744

FEDERAL RESERVED WATER RIGHTS SINCE PLLRC,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 6E.
W79-07875

PROMISING STRATEGIES FOR RESERVING INSTREAM FLOWS,
Dewsnup (Richard L.)/Dallin W. Jensen, Salt Lake City, UT.
For primary bibliographic entry see Field 6A.
W79-07878

THE NATIONAL FLOOD INSURANCE PROGRAM REVISITED - AN UPDATED MODEL ORDINANCE FOR IMPLEMENTATION OF ITS LAND MANAGEMENT CRITERIA,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-07880

CONSERVATION DISTRICTS AND 208 WATER QUALITY MANAGEMENT-NONPOINT SOURCE IDENTIFICATION AND ASSESSMENT, SELECTION OF BEST MANAGEMENT PRACTICES, MANAGEMENT AGENCIES, REGULATORY PROGRAMS,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07886

WETLANDS RELATED LEGISLATION IN THE UNITED STATES,
Miami Univ., Coral Gables, FL. School of Law.
For primary bibliographic entry see Field 6E.
W79-07888

WATER WAY PRESERVATION: THE WILD AND SCENIC RIVERS ACT OF 1968,
For primary bibliographic entry see Field 6E.
W79-07895

HARBOR LINES AND THE PUBLIC TRUST DOCTRINE IN WASHINGTON NAVIGABLE WATERS,
Washington Univ., Seattle. School of Law.
For primary bibliographic entry see Field 4C.
W79-07897

SAVING THE COAST: THE BRITISH EXPERIENCE,
Saint Catherine's Coll., Cambridge (England).
For primary bibliographic entry see Field 6E.
W79-07899

RE-EMERGENCE OF A CONTROVERSY: ENFORCING ACREAGE LIMITATION,
For primary bibliographic entry see Field 6E.
W79-07900

WATER LAW PROBLEMS OF SOLAR HYDROGEN PRODUCTION,
For primary bibliographic entry see Field 6E.
W79-07901

BIOMASS MEASUREMENTS OF BENTHIC INVERTEBRATES,

Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07920

ENVIRONMENTAL STUDIES, SOUTH TEXAS OUTER CONTINENTAL SHELF, BIOLOGY AND CHEMISTRY. VOLUME III - APPENDICES A-F.
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5C.
W79-07927

TOXIC MATERIALS IN THE AQUATIC ENVIRONMENT,
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 837, Price codes: A08 in paper copy, A01 in microfiche. Seminar Conducted Spring Quarter 1978, Report SEMIN WR 024-78, July 1978. 165 p, 23 fig, 26 tab, 129 ref. OWRT A-999-ORE (23).

Descriptors: *Aquatic environment, *Toxicity, *Water pollution, *Bioassay, *Heavy metals, *Water chemistry, *Legal aspects, Water analysis, Algae, Streams, Pesticide residues, Biodegradation, Clean Air Act, Federal Water Pollution Control Act, Water quality, Water quality standards.

A compilation of eight papers from a weekly series examining some aspects of toxic pollution of the aquatic environment is provided. The Water Resources Institute on the campus of Oregon State University serves the state by fostering, encouraging, and facilitating water research; it administers and coordinates statewide and regional programs of multidisciplinary research in water and related land resources. The topics covered are: our toxicological dilemma, algal bioassay techniques for pollution evaluation, terrestial laboratory microorganisms--their relationship to water resources, toxic materials in forest streams, toxicological considerations of heavy metals in the aquatic environment, chemicals in our water, petroleum in the marine environment, and Federal legislation for the control of hazardous/toxic substances. (Davison-IPA)
W79-07962

THE FISHERY OF THE PIEDMONT POTOMAC,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
For primary bibliographic entry see Field 5C.
W79-07972

7. RESOURCES DATA

7B. Data Acquisition

AN EMPIRICAL TRANSPORT MODEL FOR EVALUATING ENTRAINMENT OF AQUATIC ORGANISMS BY POWER PLANTS,
National Power Plant Team, Ann Arbor, MI.
J. Boreman, C. P. Goodyear, and S. W. Christenson.
Report No. FWS/OBS-78/90, November 1978. 80 p, 14 fig, 11 tab, 12 ref, 3 append.

Descriptors: *Mathematical models, *Entrainment, *Aquatic animals, *Environmental effects, Mortality, Fish populations, Distribution patterns, Life cycles, Growth stages, Aquatic habitats, Movement, Shellfish, Water pollution effects.

A generalized mathematical model incorporating empirically derived organism distribution and movement characteristics is developed for assessing the impact of powerplant entrainment mortality on fish and shellfish populations. The early life stages of these aquatic organisms which inhabit the adjacent water body or use the area as a spawning or nursery habitat are of particular concern. Estimating the conditional entrainment mortality rate, that fraction of the population which would be killed due to entrainment in the absence of any other source of mortality, is the first step in assessing the impact of entrainment mortality. The mathematical formulation is presented in which the mortality rates due to natural causes and entrainment are time-, space-, and age-specific. The input data needed involves: specifying geographic regions within the water body to define the movement and distribution of the organisms while they are vulnerable to entrainment; estimating physical factors; determining entrainment susceptibility for the life stages in each region as a function of calendar time; determining the length of time of organism vulnerability; and calculating life stages distribution among the regions of the water body as a function of calendar time. The model is applied to a hypothetical example. The limitations in the application of this model include the inability of current technology to separate the processes of mortality and movement of entrainable organisms, and the use of distribution data collected under specific conditions which may vary from year to year. (Davison-IPA)
W79-07515

COMPARTMENTED SEDIMENT TRAP,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-07538

EVAPOTRANSPIRATION COMPUTED TO ESTIMATE LEACHING FRACTIONS,
Science and Education Administration, Grand Junction, CO.
For primary bibliographic entry see Field 2D.
W79-07546

THE APPLICATION OF AERIAL AND SATELLITE SNOW-MAPPING TECHNIQUES FOR MULTI-PURPOSE RESERVOIR SYSTEM OPERATIONS IN ARIZONA,
Salt River Project, Phoenix, AZ; and Geological Survey, Phoenix, AZ. Water Resources Div.
E. Kirdar, H. H. Schumann, and W. L. Warskow.
Available from U.S. Soil Conservation Service, Courthouse, Spokane, WA. In: Proceedings of 45th Annual Meeting, Western Snow Conference, Albuquerque, New Mexico, April 18-21, 1977, p 95-101. 4 fig, 7 ref.

Descriptors: *Snow cover, *Mapping, *Arizona, *Aerial photography, *Satellites(Artificial), River basins, Water storage, Reservoirs, Snowmelt, Remote sensing, Analytical techniques, *Salt River, *Verde River.

The Salt River Project encompasses about 250,000 acres in central Arizona and provides municipal, industrial and agricultural water for a large majority of the Salt River Valley's 1.2 million residents. About 76 percent (1966-1975 average) of the Project's total annual water demand of 1,277,000 acre feet comes from its multi-purpose reservoir system. The remaining 24 percent of its total demand is produced by 255 deepwell pumps. The reservoir system is comprised of six dams having a total water storage capacity of 2,072,000 acre feet. Four of the six dams are located on the Salt River and two on the Verde River. About 75 percent of the mean annual runoff (1913-74) from the Salt and Verde Rivers originates from winter cyclonic and frontal storms during the December-May runoff season. Much of the precipitation from these storms falls as snow. Snow deposited above 7,000 feet elevation normally remains until the spring snowmelt period of March, April and May. However, about 90 percent of the total 13,000 square miles watershed lies below 7,000 feet elevation. Snow that falls on this area is ephemeral in nature and subject to very rapid melt. Because of the large areal extent of this portion of the watershed and the instability of its snowpack, very high runoff volumes have been experienced in relatively short periods of time, creating major flooding. Three satellite systems are being used to provide timely information for evaluating Salt-Verde watershed conditions. These systems, the Landsat, ITOS and SMS/GOES satellites are being evaluated under the NASA funded Applications Systems Verification Test (ASVT) on Snowcover Mapping. A brief description of each satellite system is presented with a discussion of satellite image interpretation techniques. (Woodard-USGS)
W79-07695

EXISTING STATE AND LOCAL WETLAND SURVEYS (1965-1975). VOLUME II: NARRATIVE,
Martel Labs., Inc., Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 427, Price codes: A20 in paper copy, A01 in microfiche. Prepared for Fish and Wildlife Service, Washington, D.C., Office of Biological Services, May 1976. 454 p, 119 ref, 4 append.

Descriptors: *Wetlands, *Surveys, *Legislation, Census, Data collections, Land use, Marsh management.

In preparation for a National Wetland Inventory, recent existing wetland surveys were identified. This report summarizes inventories performed in each State, and includes the reasons for the inventory, the methods used, the products prepared and key persons to contact for more information. A synopsis is provided of State Legislation that pertains to the management, protection, or identification of wetlands. (Steiner-Mass)
W79-07726

AN ISOTOPIC STUDY OF GROUNDWATER SEEPAGE IN THE CENTRAL KENTUCKY KARST,
Scottish Research Reactor Centre, East Kilbride.
For primary bibliographic entry see Field 2F.
W79-07757

INNOVATIONS SIMPLIFY SHALLOW WELL MONITORING,
National Water Well Association, Worthington, OH.
R. Gronowski.
Water Well Journal, Vol. 33, No. 6, p 57, July, 1979.

Descriptors: *Groundwater, *Water quality, *Monitoring, *Shallow wells, Water sampling, Instrumentation, On-site data collections, Propane, Pumps, Plastic pipes.

Conventional methods of monitoring ground water quality are complex, time-consuming and expensive. An innovative device for ground water sampling, developed in Canada, allows variable depth monitoring through the installation of a single length of pipe. This multilevel device consist of a bundle of polypropylene tubes within a polyvinyl chloride (PVC) pipe which permits sampling at various levels. Before water samples can be taken, the tubes must be flushed by rapid pumping. Cost of materials for a 12 meter sampler with 20 sampling points is approximately $60. Another sampling device recently developed by Johnson Div., UOP, can be used in wells with diameters as small as one inch. Pumping is accomplished through the use of a 14-once propane cylinder connected to dual-conductor plastic tubing. Propane injected down one side of the tubing forces water to rise up the other side to ground surface. The Johnson sampler is portable, easy to operate and inexpensive. These innovations will make ground water quality monitoring in shallow wells more economical and efficient. (Purdin-NWWA)
W79-07761

INVESTIGATION OF THE ORION RESEARCH AMMONIA MONITOR,
Environmental Monitoring and Support Lab., Cincinnati, OH. Instrumentation Development Branch.
R. J. O'Herron.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 648, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/4-77-028, 1977. 32 p, 12 fig, 9 tab, 14 ref.

Descriptors: *Instrumentation, *Analytical techniques, *Ammonia, *Performance, *Monitoring,

Laboratory test, On-site investigations, Waste water treatment, Sewage treatment.

The Orion Research ammonia monitor was investigated for its intended applications using Orion specifications and environmental considerations as a guide. Laboratory tests under controlled environmental conditions indicated that the electronic stability (drift) was well within + or - 10% of reading over the temperature range 5 to 42C. Sensor stability was tested by applying ammonia nitrogen in standard solutions of 10 mg/liter, 50 mg/liter, and 100 mg/liter as directed input to the monitor. Automatic standardization maintained readings within Orion's specified tolerance of + or - 10% of reading. On-stream measurements were made of a secondary sewage treatment plant effluent. These measurements were compared with those made with the standard method of distillation and titration. 65% of the comparisons were within 10% of reading. Steady-state comparisons made of field-collected samples with distillation-titration indicated that a 5% ammonia loss resulted from the straining and filtering of the sample input to the monitor. Eight of the nine samples compared were within 10% of the standard method. (Small-FRC)
W79-07776

NATIONAL WATER QUALITY GOALS CANNOT BE ATTAINED WITHOUT MORE ATTENTION TO POLLUTION FROM DIFFUSED OR 'NONPOINT' SOURCES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 2E.
W79-07889

PROBLEMS AFFECTING USEFULNESS OF THE NATIONAL WATER ASSESSMENT WATER RESOURCES COUNCIL,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 4A.
W79-07893

7C. Evaluation, Processing and Publication

MAP OF ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA, SHOWING GROUND-WATER SUBUNITS AND AREAS, LOCATION OF WELLS, AND LINES OF EQUAL DEPTH TO WATER FOR SPRING, 1978,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. G. Blankenbaker.
Geological Survey open-file map 78-937, 1978. 1 sheet.

Descriptors: *Maps, *Water wells, *Water levels, *Aquifers, California, *Antelope Valley-East Kern Water Agency area, *Groundwater subunits.

The U.S. Geological Survey has released to the open file a map showing ground-water subunits and areas, and depth to water for spring 1978, in the Antelope Valley-East Kern Water Agency area, California.
W79-07701

ROLE OF U.S. GEOLOGICAL SURVEY IN ILLINOIS,
Geological Survey, Champaign, IL. Water Resources Div.
L. A. Martens.
In: Illinois Water Resources in a Changing Environment; Proceedings of Fifth Illinois Water Resources Conference, Chicago, Illinois, June 10-11, 1977: American Water Resources Association, Illinois Section, p 48, 1977.

Descriptors: *Illinois, *Projects, *Data collections, *Available water, *Water quality, Surface waters, Streamflow, Hydrologic data, Groundwater, Management, Cost sharing, Cooperatives, *U.S. Geological Survey.

The U.S. Geological Survey (USGS), in Illinois, conducts hydrologic research, collects water resources data, and provides technical assistance to Federal, State, and local agencies. Since the 1920's, the USGS water resources program has been aided materially by financial and technical cooperation with the State and local agencies, usually on a 50-50 basis, and by transfer of funds from other Federal Agencies operating in the water resources field. The USGS determines the source, quantity, quality, distribution, movement, and availability of both surface and ground water. These data are published and disseminated for the benefit of all data users, whether at the national, State, local, or individual level. (Woodard-USGS)
W79-07711

WATER RESOURCES OF THE WACCASASSA RIVER BASIN AND ADJACENT AREAS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. F. Taylor, and L. J. Snell.
Geological Survey Water-Resources Investigations 77-101 (open-file report), 1978. 1 sheet, 7 fig, 3 tab, 6 ref.

Descriptors: *Maps, *River basins, *Available water, *Water quality, *Florida, Surface waters, Groundwater resources, Surface-groundwater relationships, Rainfall-runoff relationships, Topography, Streamflow, Water wells, Aquifers, Water utilization, Water resources development, Land use, *Waccasassa River basin.

This map report was prepared in cooperation with the Southwest Florida Water Management District which, with the Waccasassa River Basin Board, had jurisdiction over waters within the Waccasassa River basin, the coastal areas adjacent to the basin, and other adjacent areas outside the basin. New water management district boundaries, effective January 1977, place most of the Waccasassa River basin in the Suwannee River Water Management District. The purpose of the report is to provide water information for consideration in land-use and water development which is accelerating, especially in the northeastern part of the study area. It is based largely on existing data in the relatively undeveloped area. Of the total area included in the topographic drainage basin for the Waccasassa River about 72 percent is in Levy County, 18 percent in Alachua County, 9 percent in Gilchrist County, and 1 percent in Marion County. The elongated north-south drainage basin is approximately 50 mi in length, averages 13 mi in width, and lies between the Suwannee River, the St. Johns River, and the Withlacoochee River basins. (Woodard-USGS)
W79-07712

VARIATIONS IN SPECIFIC YIELD IN THE OUTCROP OF THE CARRIZO SAND IN SOUTH TEXAS AS ESTIMATED BY SEISMIC REFRACTION,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-07750

A COMPUTER PROGRAM FOR WELL LOGS,
R. B. McDannald.
Water Well Journal, Vol. 33, No. 6, p 34-35, July, 1979.

Descriptors: *Computer programs, *Drilling logs, *Well data, Data processing, Data storage and retrieval, Programming languages, Digital computers.

A computer program for the creation, sorting and searching a file of well logs is listed. It is written in BASIC and is specifically designed for the Commodore PET computer. Some minor de-bugging may be required to adapt the program for other brand home computers. Documentation of the program will be provided in a forthcoming article. (Purdin-NWWA)
W79-07758

JORDAN AQUIFER OF IOWA,
Geological Survey, Iowa City, IA.
For primary bibliographic entry see Field 2F.
W79-07769

WATBUG: A FORTRAN IV ALGORITHM FOR CALCULATING THE CLIMATIC WATER BUDGET,
Delaware Univ., Newark. Water Resources Center.
C. J. Willmott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 763, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center, Delaware University, Contribution No. 23, Report No. 1, and Publications in Climatology, Vol. XXX, No. 2, 1977. 58 p, 2 fig, 1 tab, 12 ref, 3 append. OWRT A-040-DEL(1).

Descriptors: *Computer programs, *Hydrologic budget, *Algorithms, Evapotranspiration, Water balance, Mathematics, Data storage and retrieval, Data transmission, Data collections, Soil moisture, Precipitation(Atmospheric), Air temperature, Moisture availability, Moisture deficit.

The computer program described is designed for use in a variety of problems, and requires a minimum amount of input information. Every effort was made to make the code transparent, so that it could be easily modified should additional or alternative computations be desired. Currently the program uses the Thornthwaite (1948) method for calculating potential evapotranspiration; the subroutines where the estimates are made may be replaced by another method. The advantages of WATBUG over most previously published water budget programs include: (1) budgets can be computed on a monthly or daily basis; (2) records of monthly budgets up to 40 years and daily budgets up to one year can be repeated to 'balance the budget'; (3) all relationships are explicitly specified so that 'look-up' tables are not required; (4) the program is easily modified; and (5) multiple budgets may be done in a single run. The program requires that periods of time evaluated as a single budget be consecutive. A variety of multi-annual monthly and daily data sets were used to test all WATBUG's options. Hand computations made for comparison with the results of each test run were in agreement within a mm or two. These slight differences occur because intermediate values are rounded to whole numbers at each step in hand calculations and rounding errors may accumulate. In WATBUG, rounding to the nearest whole mm takee after the budget terms have been calculated just prior to their being written on paper. (Davison-IPA)
W79-07773

MAP SHOWING GENERAL AVAILABILITY OF GROUND WATER IN THE KAIPAROWITS COAL-BASIN AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-07938

WATER RESOURCES OF THE KODIAK-SHELIKOF SUBREGION, SOUTH-CENTRAL ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
S. H. Jones, R. J. Madison, and C. Zenone.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington VA 22202 price $3.50. Geological Survey Hydrologic Investigations Atlas HA-612, 1978. 2 sheets, 22 ref.

Descriptors: *Maps, *Water resources, *Surface waters, *Groundwater, *Water quality, Hydrogeology, Aquifer characteristics, Water wells, Water levels, Hydrologic data, Precipitation(Atmospheric), Runoff, Streamflow, Specific conductivity, Water temperature, Alaska, *Kodiak-Shelikof subregion.

Hydrologic data for the Kodiak-Shelikof subregion of south-central Alaska are summarized to provide a basis for planning water resources development, identifying water problems and evaluating existing

water quality and availability. Average annual precipitation, measured at a few coastal locations in this maritime climatic zone, ranges from 23 to 127 inches. Mean annual runoff for the Kodiak Island group ranges from 4 to 8 cfs/sq mi. A maximum instantaneous runoff of 457 cfs/sq mi has been determined from a small basin on Kodiak Island. Lowest measured stream discharges range from no flow to 0.91 cfs/sq mi. Surface water is the primary source of water supplies for the city of Kodiak and other communities. The geology of the subregion is characterized by metamorphosed sedimentary and volcanic rocks with only a thin mantle of unconsolidated material. A few small, alluvium-filled coastal valleys offer the most favorable conditions for ground-water development, but moderate yields (50-100 gal/min) have been obtained from wells in fractured bedrock. Water in streams and lakes generally has a dissolved-solids concentration less than 60 mg/L, and the water varies from a calcium-bicarbonate type to a sodium-chloride type. The chemical composition of ground waters has a dilute calcium-bicarbonate type in unconsolidated materials and a sodium-bicarbonate type in bedrock. The dissolved solids in the groundwater ranges from 170 to 250 mg/L. (Woodard-USGS)
W79-07939

THE CITRONELLE AQUIFERS IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
E. H. Boswell.
Geological Survey Water-Resources Investigations 78-131 (open-file report), 1979. 1 sheet, 4 fig, 1 tab, 19 ref.

Descriptors: *Groundwater resources, *Mississippi, *Aquifer characteristics, *Water quality, *Water levels, Maps, Water wells, Water yield, Hydrogeology, Water analysis, Chemical analysis, Water utilization, *Citronelle Formation, Miocene aquifers, Pliocene aquifers.

The Citronelle aquifers consist of sand and gravel of Pliocene age that forms a discontinuous outcrop area of about 6,000 square miles in southern Mississippi. The beds dip to the south at an average rate of about 6 feet per mile. The unconfined aquifers are used mostly for domestic and farm use but also supply water to several municipalities and industries. The average saturated thickness of the aquifers is about 45 feet. This physically limits drawdown space and, although specific capacities are high, yields generally do not exceed a few hundred gallons per minute. Water levels have not declined significantly because withdrawals are small. Water quality is generally good although in some places there are objectionally high concentrations iron and in some the water is acidic.
W79-07940

WATER FOR MUNICIPAL AND INDUSTRIAL DEVELOPMENT IN HINDS, MADISON, AND RANKIN COUNTIES, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
C. A. Spiers, and G. J. Dalsin.
Mississippi Research and Development Center, 1979. 78 p, 31 fig, 10 tab, 43 ref.

Descriptors: *Mississippi, *Water resources, *Surface waters, *Groundwater resources, *Water quality, Water utilization, Hydrologic data, Water supply, Streamflow, Gaging stations, Low flow, Flood frequency, Aquifer characteristics, Water wells, Water yield, Water levels, Chemical analysis, Maps, Industrial water, Municipal water, *Hinds County(Miss), *Madison County(Miss), *Rankin County(Miss).

Hinds, Madison, and Rankin Counties occupy an area of 2,428 square miles in southwest-central Mississippi. Water use for the area during 1976 was 51 million gallons per day of which 25 million gallons per day were obtained from ground-water sources. However, the largest water user in the area, the city of Jackson, obtains most of its water from the Pearl River. Surface-water resources include the Pearl and Big Black Rivers and the Ross Barnett Reservoir. The average runoff contributed by the area to the various rivers is 1,990 million gallons per day. The chemical and physical quality of water in streams of the area is generally suitable for most uses. The principal aquifers are the Meridian-upper Wilcox aquifer, Sparta Sand, the Cockfield Formation, the Forest Hill Sand, and the Catahoula Sandstone. From Jackson southwestward the base of freshwater generally occurs at the base of the Sparta Sand. The report concludes a series of 16 multicounty water-resources investigations in Mississippi. (Woodard-USGS)
W79-07944

HYDROLOGY OF THE BEAVER VALLEY AREA, BEAVER COUNTY, UTAH, WITH EMPHASIS ON GROUND WATER,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. W. Mower.
Utah Department of Natural Resources Technical Publication 63, 1978. 90 p, 18 fig, 3 plates, 17 tab, 64 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Available water, *Water quality, Runoff, Maps, Hydrogeology, Aquifer characteristics, Water wells, Well data, Water yields, Water levels, Groundwater recharge, Consumptive use, Water supply, Irrigation wells, Groundwater movement, Model studies, Chemical analysis, *Beaver County(Utah).

Beaver Valley, which includes 534 square miles in southwestern Utah, is in the Basin and Range physiographic province. The water needs of the valley are supplied mainly by four streams rising in the Tushar Mountains, which had a mean annual inflow of 56,020 acre-feet during 1966-74, and by withdrawals from wells during the same period, which averaged 5,080 acre-feet. The total amount of water in storage in the principal ground-water reservoir in the spring of 1974 was 12 million acre-feet. The dissolved-solids concentration of water from streams, springs, and wells in most parts of the valley is less than 500 milligrams per liter. Generally, the best quality surface and ground water is at the eastern side of the valley, and the poorest quality water is at the lower southwestern part. (Woodard-USGS)
W79-07945

8. ENGINEERING WORKS

8A. Structures

SINGLE-VALVE PROTOTYPE TESTS, MAIN LOCK, LOCKS AND DAM 26, MISSISSIPPI RIVER, ALTON, ILLINOIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
D. E. Hart.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A06 1174, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper H-78-10, September 1978. 29 p, 3 tab, 2 photos, 6 pl.

Descriptors: *Locks, *Valves, *Prototype tests, *Lock and Dam No. 26, Mississippi River.

Prototype tests were conducted to determine the fastest permissible single-valve lock chamber filling (and emptying) that could be tolerated without exceeding the generally accepted maximum load per hawser of 5 tons. A number of filling valve openings were used while hawser loads and other phenomena were measured. As a result, initial filling valve opening of 3.4 ft (20 sec) was recommended. No restrictions on the emptying valve opening were found to be necessary. (WES).
W79-07530

OPTIMAL DESIGN OF CULVERTS UNDER UNCERTAINTIES,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-07549

ARSENIC IN STREAMS, STREAM SEDIMENTS, AND GROUND WATER, FAIRBANKS AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 5B.
W79-07563

SEDIMENT TRAPS IN CHANNELS--DESIGN PROCEDURES AND PERFORMANCE,
Soil Conservation Service, East Lansing, MI.
For primary bibliographic entry see Field 2J.
W79-07804

WATER RESOURCES PLANNING, MANAGEMENT, AND DEVELOPMENT: WHAT ARE THE NATION'S WATER SUPPLY PROBLEMS AND ISSUES,
General Accounting Office, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07882

WATER QUALITY CONTROL AND BLOOMINGTON LAKE,
Corps of Engineers, Baltimore, MD. Baltimore District.
F. B. Juhle.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 114-118, 5 fig, 7 ref. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Water quality control, *Dam sites, *Artificial lakes, *Earth dams, Impoundments, Flood control, River basin development, Mine drainage, Acid mine water, Alkalinity, Acidity, Acid streams, Engineering structures, Mathematical models, Stratification, Lakes, North Branch Potomac River(Maryland), Savage River(Maryland), Bloomington Lake(Maryland), Spillways.

The Bloomington Lake project, authorized by the Flood Control Act of October 1962, will be operated as a two-lake system to provide flood control, water supply, water quality, and recreational benefits. The Bloomington dam, currently under construction, will have an intake tower to control the emergency spillway flow into the outlet tunnel. The highly acid water of the North Branch Potomac River will affect the water quality of the lake which is estimated to range between pH 3.7 and pH 4.2 with an associated net alkalinity of -40 to -15 mg/l. Presently the river quality fluctuates, and during low flow periods a 2.7 pH with an associated net alkalinity of -180 mg/l has been measured. The function of the selective withdrawal intake tower is described and illustrated by schematic drawings. Mathematical modeling techniques were applied to determine lake stratification regarding temperature and acid quality, and to determine water withdrawal from the ports on the intake tower. Both models were linked and run simultaneously at various elevations to determine the optimum number and configuration of the ports. Regulation of Bloomington Lake will be geared to maintaining the best possible long-term water quality in the river downstream of the Savage River confluence. It will be necessary to maintain a constantly updated inventory of the acid stored in the lake and monitor the water quality at each level in the lake. An alkalinity inventory and quality profile will be kept for Savage River Lake, because Savage River is mildly alkaline. The water quality downstream should become constant when the system commences. (Davison-IPA)
W79-07979

8B. Hydraulics

AN ESTIMATE OF CHANNEL ROUGHNESS OF INTEROCEANIC CANALS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
G. H. Keulegan.
Available from the National Technical Information

Service, Springfield, VA 22161 as AD-A058 706, Price codes: A03 in paper copy, A01 in microfiche. Technical Report H-78-13, July 1978. 124 p, 39 fig, 23 tab, 40 ref.

Descriptors: *Canal construction, *Canals, *Roughness(Hydraulic), *Interoceanic canals.

The hydraulic roughness of the interoceanic canals created by either nuclear or conventional construction is considered. In the canals of nuclear excavation, the part of resistance due to the ejecta is estimated on the basis of distribution of size of ejecta material; and the part due to the expansions and contractions in the canal created by the explosives is attributed to the isostatic losses from free turbulence. For the conventional canals charged with very fine sediment, the friction of the granular surfaces is assumed to be that in a hydrodynamically smooth surface. In the presence of bed features, the added form resistance is estimated from the findings of Alam and Kennedy concerning alluvial rivers. A detailed study of resistance noted in Fort Collins tests shows that there is a difference in the frictional processes between the laboratory flumes and the natural rivers, suggesting that for resistance estimates reliance should be placed on river calibration. (WES)
W79-07529

SIDE WEIR IN RECTANGULAR CHANNEL,
Roorkee Univ. (India). Dept. of Civil Engineering.
K. G. Ranga Raju, B. Prasad, and S. K. Gupta.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Proceedings Paper 14596, p 547-554, May 1979. 6 fig, 1 tab, 8 ref, 2 append.

Descriptors: *Weirs, *Subcritical flow, *Laboratory tests, *Hydraulic models, Data processing, Irrigation, Sewers, Channels, Flow, Energy, Hydraulics, Side weirs, Broad-crested weirs, Sharp-crested weirs.

The discharge characteristics of a side weir at the head of a branch channel taking off at right angles to the main channel were investigated. Both sharp-crested and broad-crested weirs were studied for the case of subcritical flow in the main channel. A procedure of design based on De Marchi's theory was evolved. The De Marchi coefficient is empirically related to the Froude number at the upstream end of the weir, and the ratio of the upstream depth (above the weir crest) is related to the length of the weir. (Sims-ISWS)
W79-07534

TWO-DIMENSIONAL FLOW FIELD OF MULTIPORT DIFFUSER,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
P. J. W. Roberts.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Technical Note, p 607-611, May 1979. 3 fig, 5 ref, 1 append.

Descriptors: *Outfall sewers, *Flow characteristics, *Hydraulic structures, *Diffusion, Oceans, Hydraulics, Outlets, Shallow water, Analytical techniques, Laboratory tests, Jets, Flow, Dimensional analysis, Distribution patterns, Multiport diffuser, Plumes, Buoyant jets.

The two-dimensional flow field in the center of a long, multiport ocean sewage outfall diffuser was considered. The gross properties of the flow are predicted by simple dimensional arguments, assuming that the diffuser is approximated by a line source of buoyancy flux only, i.e., a pure plume. The results of two-dimensional experiments were presented. For fairly small times, the thickness of the surface layer is constant and independent of the source buoyancy flux. The surface layer occupies about 30% of the water depth, and advances, due to a balance of pressure and inertia forces, at a constant speed. For long times, the spreading of the surface layer is governed by a balance of pressure and interfacial shear forces. The thickness of the wastefield then grows slowly with time, and the length grows as the 4/5 power of time. Comparison of the results with those of the initial spreading phase of larger scale experiments on model multiport sewage outfall diffusers showed close agreement. (Humphreys-ISWS)
W79-07535

L.N. FAN'S DATA ON BUOYANT JETS IN CROSSFLOW,
McGill Univ. (Montreal). Dept. of Civil Engineering and Applied Mechanics.
V. H. Chu.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY5, Technical Note, p 612-617, May 1979. 4 fig, 7 ref, 1 append.

Descriptors: *Jets, *Flow characteristics, *Diffusion, Hydraulics, Laboratory tests, Open channel flow, Analytical technique, Analysis, Spatial distribution, Discharge(Water), Buoyant jets, Crossflow.

The experimental data by F.L. Fan on buoyant jet in a crossflow was successfully correlated and presented in a rather simple manner in this paper, using a set of dimensionless variables suggested by a line impulse model. There have been other more sophisticated analytical models developed in recent years, but the advantage of the simple model lies in the fact that experimental results can be correlated by simple formulas which can be used readily by practicing engineers. It also provides a better basis for further study on related problems with more complex initial conditions. It is important to point out that in the limiting case when the crossflow is very small, the simple formulas presented in this paper are not applicable in the region close to the exit. Wright has recently proposed a method to deal with the problem in such a limiting case. (See also W69-08423 and W77-09013) (Humphreys-ISWS)
W79-07536

OPTIMAL DESIGN OF CULVERTS UNDER UNCERTAINTIES,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-07549

FLOW CHARACTERISTICS IN TWO-DIMENSIONAL EXPANSIONS,
S. V. Regional Coll. of Engineering and Technology, Surat (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-07551

WATER TEMPERATURE EFFECTS ON HORIZONTAL BUOYANT SUBMERGED JETS,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
J. B. Riester, R. A. Bajura, and S. H. Schwartz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 293, Price codes: A08 in paper copy, A01 in microfiche. Research Report No. 4, September 1977. 144 p, 59 fig, 1 tab, 23 ref, 3 append. OWRT C-7171 (No. 6214) (1), 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, *Stratification, Reynolds number, Jets, Reservoir operation, Buoyancy.

Experimental and analytical studies were performed on submerged buoyant fresh water and salt water jets ejected horizontally into calm ambient water. The behavior of fresh water jets was found to be dependent upon the jet and ambient water temperatures as well as the Froude number and Reynolds number. As the ambient temperature was lowered, the jets penetrated to a greater horizontal. The jet width, centerline velocity, and centerline temperature also changed with ambient temperature. The jet trajectory was also shown to change with jet temperature. The trajectory of salt water jets was found to change with salt concentration in the jet. As salt concentration was lowered, the jets penetrated to a greater horizontal distance for the same Froude number. Results are presented for various ambient and jet temperatures, and concentration levels for salt water jets. The results may be used in predicting trajectories, velocities, temperatures, and widths of fresh water jets, and trajectories of salt water jets. The nozzle geometry was shown experimentally to have a small effect on the jet trajectory. The turbulent mixing in fresh water jets was found to be independent of Reynolds number above a Reynolds number of 1550. The results of the nozzle geometry and Reynolds number studies are useful in formulating model studies.
W79-07572

MIXING IN RECTANGULAR TANKS USING HORIZONTAL JETS,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
D. L. Taylor, S. H. Schwartz, and R. A. Bajura.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 298, Price codes: A07 in paper copy, A01 in microfiche. Research Report No. 5, October 1977. 115 p, 34 fig, 4 tab, 19 ref, 3 append. OWRT C-7171 (No. 6214) (2), 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, *Stratification, Reynolds number, Jets, Reservoir operation, Buoyancy.

The objectives were to determine the factors which affect the degree of thermal mixing that occurs when two rectangular tanks exchange water in a cyclical manner. The experiment tests were conducted with two types of initial conditions - (1) both tanks initially at a uniformly mixed temperature, and, (2) a two layer stratification profile in one tank with the thermocline located at the jet outlet. The independent test parameters were represented in nondimensional form by the Froude number, the Fourier number, and the number of cycles of operation. A stratification parameter, S, based on the center of gravity of the buoyancy of the water in the tank, was developed. For each of the initial conditions tested, a general correlation for the stratification parameter as a function of the dimensionless parameters was found. The functional relationship was based on the assumption that the amount of mixing that occurs within the tank is proportional to the volume of fluid entrained by the jet and the initial Froude number of the test. If the fluid is injected into a uniformly mixed tank, the stratification in the tank will be increased and then eventually decrease to the uniformly mixed state. A fluid jet injected at the thermocline of a strongly stratified tank will cause the stratification in the tank to decrease and eventually approach the uniformly mixed state. The destratification rate of a tank was found to be a function of the Froude number, the Fourier number, and the number of cycles of operation.
W79-07573

A NUMERICAL SIMULATION FOR A PUMPED STORAGE RESERVOIR,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
J. D. Faber, R. A. Bajura, and S. H. Schwartz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 290, Price codes: A08 in paper copy, A01 in microfiche. Research Report No. 7, October 1977. 153 p, 83 fig, 4 tab, 15 ref, 4 append. OWRT C-7171 (No. 6214) (3), 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, *Stratification, Reynolds number, Jets, *Reservoir operation, Buoyancy, Numerical analysis.

A computer program was developed to numerically simulate the velocity and temperature fields in an idealized two-dimensional pumped storage reservoir. The reservoir model includes a submerged inlet and a rising upper boundary to simulate rising water surfaces due to inflow. The solution is obtained by solving the energy, vorticity, and stream function equations using various finite differencing techniques. The eddy viscosity and eddy conduc-

tivity terms in the equations were considered constant. The nodal spacing and the time step used were found to be the major parameters affecting stability. Results were obtained for a series of test cases with different percentages of the initial volume added. Cases were run for 0% of the initial volume added (or a constant surface level), for 15% added, and for 30% added. For each percentage of volume increase, Froude numbers of 3.16, 10, and 21.6 were run. The results are in qualitative agreement with experimental predictions for flow fields.
W79-07574

EFFECT OF VERTICAL SCALE DISTORTION ON THE TEMPERATURE FIELD OF A THERMAL-HYDRAULIC MODEL,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
D. P. Michelotti, R. A. Bajura, and S. H. Schwartz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 274, Price codes: A07 in paper copy, A01 in microfiche. Research Report No. 9, October 1978. 115 p, 34 fig, 12 tab, 11 ref, 2 append. OWRT C-7171 (No. 6214) (4), 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, *Stratification, Reynolds number, Jets, Reservoir operation, Buoyancy.

The objectives were to determine the effects of a vertical scale distortion on the flow and temperature fields of a hydraulic model of a pumped storage reservoir system. The study considered vertical to horizontal scale ratios of 1:1, 3:1, and 5:1. The model consisted of a submerged hot water jet discharging into an initially cold isothermal reservoir. The jet discharge geometry was patterned after what was considered to be a typical pumped storage outlet. Results are presented for various jet Froude numbers. Thermal mixing was demonstrated to be a function of the jet Froude number and the model distortion factor. A stratification parameter and an energy distribution parameter were developed to describe the characteristics of the reservoir in terms of the vertical temperature distribution. Temperature data for each experiment were correlated as a function of the Froude number, the distortion factor and the stratification and energy distribution parameters. Reservoir stratification was found to decrease as the jet Froude number is increased. It was also found that less thermal stratification occurred as the model distortion factor is increased.
W79-07575

PUMPED STORAGE SURVEY,
West Virginia Univ., Morgantown. Dept. of Mechanical Engineering and Mechanics.
J. B. Riester, S. H. Schwartz, and R. A. Bajura.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-297 329, Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 3, September 1976. 43 p, 31 fig, 3 append. OWRT C-7171 (6214) (6), 14-34-0001-6214.

Descriptors: *Pumped storage, Hydraulic models, Turbulence, Mixing, Froude number, Tailrace, Reservoirs, *Stratification, Reynolds number, Jets, Reservoir operation, Buoyancy, Hydraulic structures.

This report presents a summary of data obtained from a survey sent to over 50 power companies concerning the operation and planning of pumped storage hydroelectric generating stations. The data were organized into the three categories of power output, geometric characteristics of sites, and operational considerations. Much of the data are presented in the form of histograms to summarize the statistical results into subcategories of interest. The information contained in this survey will be used to aid in the process of selecting reservoir models for study under the West Virginia University Pumped Storage Model Study program.
W79-07576

PERMEABLE WALL EFFECTS ON POISEUILLE FLOW,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W79-07749

8C. Hydraulic Machinery

BIT MAINTENANCE,
Ingersoll-Rand Co., Phillipsburg, NJ.
G. Doyle.
Water Well Journal, Vol. 33, No. 6, p 47-49, June, 1979.

Descriptors: *Drilling equipment, *Maintenance, *Drill bits, Drilling, Rocks, Abrasion drill bits, Air-percussion drilling.

Tungsten carbide button bits are used effectively for percussion drilling in medium and hard rock formations. They are not self-sharpening and need periodic maintenance to maximize bit life and penetration rates. The bits are designed for efficient rock breakage and hole cleaning if used properly. Several rules for efficient percussion drilling are given. Frequency of bit reconditioning depends on drilling conditions. In hard-abrasive rock, a flat spot on a button should be immediately ground to a spherical shape. In soft or hard non-abrasive formations the buttons should be ground before reaching 10% expected bit life, even if no flat spots are visible. Bit maintenance also requires grinding the air blowholes and chip clearance grooves, greasing the threaded joint, and checking the body, splines, and striking end. Grinding requires a vitrified silicone carbide wheel one to two inches in diameter and an inch wide, rated at 24,000 rpm or more. (Purdin-NWWA)
W79-07509

GROUND WATER HEAT PUMP UPDATE,
National Water Well Association, Wothington, OH.
D. Bacon.
Water Well Journal, Vol. 33, No. 6, p 44, June, 1979.

Descriptors: *Heat pumps, *Research and development, Laboratory tests, Projects, Heating, Coaling, Efficiencies, Discharge(Water), Groundwater.

Examples of residential developments incorporating ground water geothermal heat pumps are given. The heat pump's high operating efficiency gives these homes a distinct marketing advantage over homes with conventional heating and cooling systems. The Department of Energy has contracted with the National Water Well Association to investigate the hydrologic characteristics, costs, and environmental and legal aspects of heat pump use. George Smith, Inc. has begun a project to evaluate the efficiency of ground water geothermal heat pumps under controlled laboratory conditions. (Purdin-NWWA)
W79-07640

HACKMATACK MADE RELIABLE HAND PUMPS,
Canadian Water Well, Vol. 5, No. 2, p 6, May, 1979.

Descriptors: *Pumps, *Hand pumps, *Appropriate technology, *Lumber, Conifer trees, Fabrication, Water wells.

The technique of fabricating wooden hand pumps is described in detail. It involves boring one or more logs to be used as casing. Many types of wood can be used, but the best is from a conifer called Hackmatack. A lathe is used to shape the spout and plunger. After turning, the plunger is cut to form a flexible joint with the plunger rod and the valve and pump leather are attached. The pump leather makes a seal between the plunger and cylinder walls. The valve, also of leather, is taked to the top side of the plunger to provide a seal when the plunger is raised (thus causing the vacuum which raises the water), and opening on the downward stroke to fill the upper casing with water. These pumps are capable of drawing water from 20 feet below the surface. (Purdin-NWWA)
W79-07723

WATER SYSTEM BASICS - TROUBLESHOOTING FOR JET PUMPS,
Ground Water Age, Vol. 13, No. 9, p 13-15, 50, May, 1979. 5 tab.

Descriptors: *Jet pumps, *Pump testing, Charts, Maintenance, Repairing.

Troubleshooting charts for jet pump installation are presented in an easy to follow format. Five major problems are covered in five separate charts. These are: (1) the pump doesn't start or keep running; (2) the motor overheats and overload trips out; (3) the pump starts and stops too often; (4) the pump operates but delivers little or no water; and (5) the pump doesn't shut off. Several causes of each problem are listed along with techniques for checking and testing and procedures for correcting the problem once the cause has been determined. The charts are arranged in sequence so that the easiest checks are made first. In only a few cases is it necessary to pull the piping ejector or foot valve from the well. Most of the work can be done at the surface. (Purdin-NWWA)
W79-07738

8F. Concrete

LINER MATERIALS EXPOSED TO HAZARDOUS AND TOXIC SLUDGES,
Matrecon, Inc., Oakland, CA.
For primary bibliographic entry see Field 8G.
W79-07779

8G. Materials

BIT MAINTENANCE,
Ingersoll-Rand Co., Phillipsburg, NJ.
For primary bibliographic entry see Field 8C.
W79-07509

LINER MATERIALS EXPOSED TO HAZARDOUS AND TOXIC SLUDGES,
Matrecon, Inc., Oakland, CA.
H. E. Haxo, R. S. Haxo, and R. M. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 013, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-081, 1977. 62 p, 16 fig, 16 tab, 59 ref, 3 append.

Descriptors: *Linings, *Chemical wastes, *Waste disposal, *Durability, *Elastomers, Polymers, Oily water, Acids, Alkalis, Plastics, Pesticides, Oil wastes, Membranes, Concretes, Cements, Engineering structures, Waste water disposal, Industrial wastes, Sludge disposal.

The effectiveness and durability of various liner materials were examined for the interception and control of leachate from hazardous and solid wastes disposal sites. The materials evaluated as possible liners included: a native soil, modified bentonite, a soil cement, a hydraulic asphalt concrete, an asphaltic membrane, and 8 polymeric membranes based on polyvinyl chloride, chlorinated polyethylene, chlorosulfonated polyethylene, ethylene propylene rubber, neoprene, butyl rubber, an elasticized polyolefin, and a thermoplastic polyester elastomer. The potential liner materials were exposed to the hazardous wastes, a strong acid, a strong base, oil refinery tank bottom waste, a combination of lead wastes from gasoline production, saturated and unsaturated hydrocarbon oil waste, and a pesticide. Preliminary results of the study indicated that some of the liner materials were not compatible with certain wastes and several combinations were eliminated, such as asphalt materials with oily wastes. Oily wastes were not compatible with noncrystalline polymeric membranes. Strong acids, bases, and concentrated brines adversely affected bentonite liners, polymer modified bentonite, and some soils. Aqueous wastes containing oily

phases posed the problem of the liners simultaneously resisting two components which were inherently different in their compatibility with materials. (Lisk-FRC)
W79-07779

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

GROUND WATER HEAT PUMP UPDATE,
National Water Well Association, Wothington, OH.
For primary bibliographic entry see Field 8C.
W79-07640

RESEARCH OF THE U. S. FISH AND WILDLIFE SERVICE,
Fish and Wildlife Service, Washington, DC. Div. of Population Ecology Research.
J. A. McCann.
In: The Freshwater Potomac, Aquatic Communities and Environmental Stresses, Proceedings of a Symposium, January 1977, College Park, Maryland, Flynn, K. C. and Mason, W. T., Eds., 1978. p 97-101. Interstate Commission on the Potomac River Basin, Rockville, Md. Technical Publication 78-2.

Descriptors: *Laboratories, *Research and development, *Wildlife, *Fish conservation, Pesticide toxicity, Fish reproduction, Fish conservation, Fish diets, Spawning, Fish behavior, Limnology, Fish diseases, Aquatic habitats, Aquatic environment, Toxins.

The activities of some of the fishery-oriented laboratories within the U. S. Fish and Wildlife Service which may be of particular interest to the Potomac basin are discussed. Work at the Fish Pesticide Research Laboratory, Columbia, Missouri, is concentrated on toxicological appraisal of the short- and long-term effects of pesticides and phthalate esters on reproduction, growth, and survival of fish and other aquatic organisms. The internationally known Patuxent Wildlife Research Center, Laurel, Maryland, conducts studies on contaminants in the Potomac River-Chesapeake Bay system focusing on critical problems of endangered species and migratory birds. The ecology of the Great Lakes is evaluated at the Great Lakes Fishery Laboratory, Ann Arbor, Michigan, where research on resource assessment, population ecology, fish psychology, and limnology is conducted. Research on restoration of the Atlantic salmon to its historic spawning grounds is carried out at the University of Maine, Orono. At the Eastern Fish Disease Laboratory, Leetown, West Virginia, studies of the diseases of sport and commercial fish are conducted. Cooperative Fishery Research Units, established at 25 major universities throughout the country, conduct coordinated cooperative research, and provide fishery resources related advance training programs. During the past decade fisheries Federal aid program has funded $67 million for fisheries and environmental research and general studies. (Davison-IPA)
W79-07976

9D. Grants, Contracts, and Research Act Allotments

FEDERAL WATER POLLUTION CONTROL ACT CONSTRUCTION GRANTS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-07884

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

THE NATIONAL WATER DATA STORAGE AND RETRIEVAL SYSTEM (WATSTORE) OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Showen.
Paper presented at First NAWDEX Membership Conference, Denver, Colorado, May 9-11, 1978. 7 p, 1 fig.

Descriptors: *Data storage and retrieval, *Computers, *Information exchange, *Hydrologic data, *Data processing, Automation, Information retrieval, *National Water Data Storage and Retrieval System(WATSTORE).

As a part of the Geological Survey's program of releasing water data to the public, a large-scale computerized system, the National Water Data Storage and Retrieval System (WATSTORE) was developed. The WATSTORE system provides for the processing, storage, and retrieval of water data pertaining to surface water, quality of water, and ground water. At present (1978), there are 60 Geological Survey remote job entry sites, located in various offices throughout the country, that are equipped with high-speed computer terminals for remote access to the system. There are 36 terminals located in other Federal agencies and 13 terminals located in non-Federal governmental agencies that have access to the system. The primary use of the system by these agencies is to retrieve raw data for further analyses or to use the Geological Survey data files and computer programs to provide standard analytical results. (Woodard-USGS)
W79-07952

10C. Secondary Publication And Distribution

BIBLIOGRAPHIC SOURCES OF COMPUTER PROGRAMS AND NUMERICAL MODELS IN HYDRAULICS,
Geological Survey, Reston, VA. Water Resources Div.
C. Lai.
American Society of Civil Engineers, Hydraulics Division, Task Committee on Computational Hydraulics, August 1978. 13 p, 9 ref.

Descriptors: *Bibliographies, *Computer programs, *Mathematical models, *Hydraulics, *Indexing, Hydrology, Surface waters, Groundwater, Thermal water, Estuaries, Documentation.

In the fall of 1977, the Hydraulics Division of the American Society of Civil Engineers organized a new committee called 'Task Committee on Computational Hydraulics'. As one of its duties, the Committee at its first official meeting, held at the National Center of the U.S. Geological Survey on October 28, 1977, looked into the availability of mathematical, numerical and computer models for general use by hydraulic engineers. Many organizations and individuals have responded to the calls of the Task Committee to compile a list of bibliographies on computer programs and numerical models in hydraulics. This list has been prepared largely based on such responses and contributions. Part I contains sources that are in a form of formal publication and can be quoted by a proper reference or identification. Part II is composed of ad hoc lists prepared for the request of the Task Committee or informal lists, each of which may have previously been made for various purposes. Several small lists, each containing only a few programs or models, are catalogued in Part III. In addition to those contained in Parts I, II, and III, there were some which the editor was unable to classify or include in the above three parts. These are placed in Part IV. (Woodard-USGS)
W79-07703

THE NORTH CAROLINA COASTAL ZONE AND ITS ENVIRONMENT, VOLUME II. A COMPILATION OF RESOURCE MATERIALS COVERING THE COASTAL PLAIN, ESTUARIES, AND OFFSHORE WATERS,
Available from the National Technical Information Service, Springfield, VA 22161 as DP-1423, Price codes: A09 in paper copy, A01 in microfiche. E. I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, South Carolina. Report DP-1423, November 1977. 389 p. DOE AT(07-2)-1.

Descriptors: *Bibliographies, *Southeast, North Carolina, Coastal plain, Estuaries, Continental shelf, Hydrology, Weather, Charts, Maps.

A compilation of 630 oceanographic resource materials covers the coastal zone and continental shelf of the southeast. Subjects included in the second volume are: (1) hydrology and groundwater, (2) oceanography, (3) weather and climate, (4) miscellaneous, and (5) charts, maps, and atlases. Indexes by author, geography, and subject are given along with a list of journal and serial publications cited. (Bollinger-Mass)
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- Ground and surface water hydrology at the Illinois State Water Survey.

- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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